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MR. JAMES WHITE.

Commission of Conservation
Canada

WATER POWERS
OF
BRITISH COLUMBIA

Including a Review of Water Power Legislation relating thereto and a Discussion of Various Matters respecting the Utilization and Conservation of Inland Waters

BY

ARTHUR V. WHITE

Consulting Engineer, Commission of Conservation

Assisted by

CHARLES J. VICK

OTTAWA, 1919

LC

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Foreword

This Report is a compendium of data relating to the water-power resources of British Columbia. The opening chapters comprise a statement of the guiding principles which should govern in the conservation and utilization of inland waters ; and a description of certain important features which should characterize reliable water-power data. There follows a comprehensive, historical survey of Water Legislation in the Province, together with discussions of subjects cognate thereto.

In the portion of the Report which relates more particularly to physical data, will be found tabular lists of the estimated possibilities of water-power sites throughout the Province, which lists are based chiefly upon results obtained from the special field investigations conducted by the Commission of Conservation. There then follow digests of stream-flow, meteorological and other hydrometric records.

The Commission of Conservation heartily appreciates the assistance rendered by governmental, corporate and private agencies in supplying desired data. Detailed acknowledgments for these data will be found in Chapter I, and elsewhere at appropriate places throughout the Report.

In conclusion, it is not amiss to mention that, owing to circumstances created by the Great War, the publication of this Report has been much delayed.

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Plate 1

PEND D'OREILLE RIVER

Important undeveloped power site near the confluence of Salmon river

WATER-POWERS OF BRITISH COLUMBIA

CHAPTER I

General Introduction

IN January, 1910, the Commission of Conservation commenced the investigation of the character and extent of the various natural resources of Canada. Early in 1909, the Canadian delegation to the North American Conference at Washington had compiled a general statement respecting the available water-power data. This compilation served to demonstrate the inadequacy of our information respecting this valuable natural resource. The Commission, therefore, decided to prepare an inventory of the water-power resources of the country, and, in so doing, avoided duplication of effort by utilizing all available information from governmental and other sources.

The Commission commenced its own reconnaissance field work in the eastern provinces and, in 1911, published *Water-Powers of Canada*, which presents, in summary form, the information then available for the provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario. Owing to the paucity of information available, it was not then possible to do more than describe briefly the water-power resources of the provinces of Manitoba, Saskatchewan, Alberta and British Columbia.

In 1916, the report on the *Water-Powers of Manitoba, Saskatchewan and Alberta* was issued. The present volume on *Water-Powers of British Columbia* completes the series of water-power reports which the Commission, in 1910, undertook to publish.

The paucity of information concerning British Columbia water-powers existing when the Commission undertook its work, is well expressed in the *British Columbia Year Book*, for 1911, which states :

"Speaking generally, there is no subject of economic interest in connection with the exploitation of the provincial resources concerning which there is less known than the extent to which water-powers may be rendered available."

The Provincial Government desired, as soon as satisfactory arrangements could be made, to proceed with a more detailed investigation of its water-powers. Before doing this, however, it was deemed necessary to deal with a complex problem which had gradually developed, as a result of the methods formerly employed in the granting of 'rights' for the use of waters.

In the early 'fifties' the taking up of water rights and privileges for mining operations commenced, and, subsequently, others were granted for irrigation of large agricultural areas, until upwards of 6,000 water records had been issued, under various terms and conditions. In addition, other records and privileges were granted for the use of water for power. The result was

that many of the rights conferred overlapped and caused conflict of interests and hindrance to the most beneficial use of the waters of some of the provincial streams. The earlier water-power developments were used, chiefly, in connection with the mining industry, and it is only since the advent of high tension transmission, coupled with the great advancement in the industrial arts, that the importance of the development of water-power resources has claimed fuller attention.

The British Columbia Government, when interviewed by the representatives of the Commission of Conservation, prior to the commencement of their field operations in 1911, explained its water problems as above outlined, and expressed its desire that the Commission proceed with its proposed investigation. Recognizing that this research could not be made without very special effort and at considerable expense, the former Premier, Sir Richard McBride, and Minister of Lands, Hon. W. R. Ross, agreed that the province would render every possible assistance. Subsequently, through the Minister of Lands, funds were provided by the province supplementing the appropriation made by the Commission. This enabled the placing of larger parties in the field, and thus expedited the work.

Conditions in British Columbia are Exceptional

The season available for such reconnaissance water-power investigations as were made in British Columbia is comparatively short. One of the chief difficulties encountered is, that it is almost impossible for observers to avoid over-recording in their notes the power possibilities of streams observed during high stages. Young engineers are impressed by the quantity of water coming down the rivers, and have not the advantage of having observed the same streams at their low winter stages, nor have they always the knowledge of measurements of the flow of similar streams with which to temper their judgment. Engineers in charge of similar work in the United States have experienced like difficulty, and have, therefore, endeavoured, as much as possible, to have the work performed when the streams are neither approaching nor at their flood stages. This fact indicates why the time, during which these special investigations may profitably be pursued, is so limited.

The conditions affecting powers in the province are unique, and do not closely correspond to those existent in other portions of Canada. This is especially true of the mainland Pacific coast. One cannot but be impressed with the fact that coastal water-powers in British Columbia, which to the casual observer appear to be of comparatively small amount, nevertheless, may, when economically and fully developed, yield several-fold the estimate of power if appraised upon the same basis as similar streams in Eastern Canada. Glaciers, snow-fields, and heavy rainfall abound, and, with many storage possibilities, constitute unique factors which contribute to enhance the values of powers. These conditions, on the other hand, emphasize the necessity of special and very careful engineering investigation and expert handling.

Field parties necessarily experienced considerable physical hardship in the prosecution of the work in such rugged country. The following statements,

taken from the reports of field parties, convey some idea of the more serious difficulties encountered, in the course of the work. One report says :

"Considerable risk was encountered in ascending the Klinaklini river, as it was in flood, with the current most of the way averaging four or five miles per hour, and in places six to ten miles. Sometimes the canoe had to be dragged along by means of the overhanging branches of bordering trees, the water being too swift for oars or paddles and too deep for poling. At some places it was necessary to wade for several hours in water at a temperature little above freezing. In places, quicksands were met with. When poling, sometimes the pole would sink six or eight feet in quicksand before finding firm bottom. After seven days' hard work we reached the main forks of the river. One fork comes from a glacier obstructing the valley, while the other fork consists of a long cañon up which it was impossible to proceed by canoe. This cañon was examined for fifteen miles. On the return trip we were unfortunate enough to be wrecked on a snag while rounding a sharp bend, and lost our canoe and equipment. Two other parties, on other work, who had made similar attempts the previous year, were also wrecked, but these had failed to reach the forks. After the accident we had to walk two days without food or blankets, to the mouth of the river, swimming two small branches en route, and we were pleased indeed to see the *Lizette* again."*

In another report, the engineer states :

"The trails of the Kispiox watershed were not much travelled and consequently not well marked and required clearing, so that progress was necessarily slow ; also such bridges as existed were rotted and unfit for traffic.

"The trails of the Skeena valley were very badly cut up and full of mud holes, and, where they followed the side hills, very slippery and dangerous, so that horses slipped and fell frequently, being thus cut and bruised and otherwise injured. One horse fell off a bridge, breaking two of its ribs and being otherwise injured so as to be no longer fit for use. The main trail up the Skeena river passes over a series of hills and deep-cut gulches, which are practically bare, with comparatively few spots where sufficient feed for working animals can be obtained. The season of 1913 being exceedingly wet and cold in the northern interior, the grasses did not ripen, making, in consequence, very poor feed. This, added to the rough condition of the trails, made the horses very weak and entirely unfit for a long season's work."

Throughout the whole of the investigation, the Provincial, as well as the Federal and other authorities, have rendered hearty and valuable assistance. United States officials have unfailingly furnished data wherever possible. Acknowledgments for the various data received from the British Columbia Hydrometric Survey of the Water Power Branch, Dept. of Interior, Ottawa : from the Provincial Water Rights Branch, Victoria ; from the Meteorological Service, Toronto ; from the United States Geological Survey, Washington ; from the United States Weather Bureau, and from other governmental and private sources, are specifically referred to elsewhere in the report. For all the assistance received, the Commission of Conservation is deeply appreciative and desires to express its gratitude.

Those upon the Commission of Conservation staff of field engineers, who chiefly assisted in connection with the various field investigations, and to whom credit is due for their good efforts, are: G. H. Ferguson, C. J. Vick, D. C. Jennings, C. C. Lyall, A. W. Campbell, L. G. Mills, T. G. Bird, R. Westover,

*The *Lizette* was the forty-foot gasolene launch used by the Commission for the coast work.

W. A. Wand, F. R. Macdonald, B. Corbould, B. N. Simpson, C. C. Cowan, and also to A. J. McPherson, who was attached to one of the field parties in 1913 as representative of the Provincial Water Rights Branch. Special investigation was made on some streams by provincial engineers as follows: On Vancouver island, by F. W. Knewstubb; in Nelson district, by W. J. E. Biker; in Kettle Valley district, by C. Varcoe; in Cranbrook district, by H. B. Hicks, and in the Okanagan district, by J. C. Dufresne. Able assistance was also rendered in connection with special office researches by C. A. Pope, E. Davis, J. Moncton Case, Andrew Paton, H. A. Wildy, R. S. W. Baird and Miss E. I. Gilby.

Total Estimated Horse-Power

Grand totals purporting to represent horse-power possibilities for large sections of a country are apt to be very misleading. They are especially misleading when used to make comparisons with other totals when, as a matter of fact, no real basis for comparison has been established. The unique character of many of the water-power possibilities of British Columbia, with its exceptional physical features, such as mountain systems, glaciers, snow-fields, and widely variant precipitation, necessarily makes it difficult to effect comparisons between the total water-power possibilities of this province and those of other areas differing markedly in physical characteristics. However, it will be interesting to present in round numbers certain totals of horse-power derivable from the various estimates* presented in our tables.

Conventionally, the province has been divided into districts, as follows:

		24-hour horse-power
I.	*Columbia River and Tributaries:* (North of the international boundary): This comprises the portion of the province lying between its eastern boundary and the watershed of the Fraser river	610,000
II.	*Fraser River and Tributaries:* This includes practically the entire area of the great Interior plateau	740,000
III.	*Vancouver Island*	270,000
IV.	*Mainland Pacific Coast and Adjacent Islands:* (except Vancouver Island): This includes all the rivers north of the Fraser which drain into the Pacific	630,000
V.	*Mackenzie River Tributaries:* (A rough estimate made for inclusion in this summary)	250,000
	Grand total	2,500,000

The above totals include about 250,000 horse-power† for plants already in operation, but they do not include about 400,000 horse-power‡ given in the

*For characteristics and limitations applicable to the estimates, consult 'Description of Power Tables,' also notes accompanying the power tables.

†It should be borne in mind that the estimates presuppose continuous 24-hour power, and hence, in deriving this 250,000 h.p., totals representing installed capacities of individual plants were sometimes not the quantities used.

‡A proper estimate of this power is somewhat problematical and this figure might, perhaps, be increased. However, the various factors represented by this total may be determined by reference to the power tables.

tables for power possibilities on streams like the Fraser, Thompson, Skeena and Nass rivers, on which, because of the proximity of railways, or possible interference with the salmon industry, economical development cannot be considered under present conditions. Also, as elsewhere explained, there is still considerable territory, especially in the more northerly portion of the province, which it has not been possible to investigate fully. These areas may yet disclose a considerable amount of power. One fact to be borne in mind in connection with these totals is that, when powers are developed and the available waters are intelligently conserved, more power will be obtained than the quantities estimated upon the basis of available data would, at present, indicate.

In round figures, the total estimated 24-hour power, including an allowance for all of the entities above mentioned, may be placed at about 3,000,000 horsepower.

Water as a Natural Resource

Water-power development is but one of the important uses to which many of our inland waters may be applied. Too frequently, in reports on water-power resources, it has been the tendency to deal with power development exclusively, without adequately considering such related subjects as domestic and municipal supply, agriculture and irrigation, navigation, fisheries, and riparian rights.

There has been a tendency on the part of many persons interested in the conservation of natural resources to emphasize that this or that particular resource is the *most* important. Some have contended that the forests are the most important asset, others coal, others maintain that the soil, with its fertility, is the most important, and, of late years, great stress has been laid upon the statement that water is the chief asset—the prediction being made that the nation which has the most and cheapest water-power available is destined to take precedence in the world of commerce. As a matter of fact, however, all these various interests are interdependent. If any one feature of our natural resources is to be placed before others, probably it could be most reasonably urged that a fertile condition of the soil is the most important natural asset to be safeguarded ; because, for his sustenance on the earth, man requires food, raiment, and shelter, and these essentials are supplied him, in one form or another, either directly or indirectly, from the soil. It must be manifest, therefore, that the factors which make for the permanence of the soil's productivity are of paramount importance; and hence the subject of the conservation and use of waters as a natural asset must, among other things, be considered in its prime relationship to the subject of the productivity of the soil.

It should be borne in mind that the greatest danger which besets the natural resources of not only this country, but of the world, is the undue disturbance of the balance which Nature seeks to maintain. Hence, in presenting the data which follow, no special effort has been made to attach an importance to water-power, *per se*, to which it is not entitled.

Precipitation, in the form of rain or snow, virtually constitutes the only source of inland water supply. Its distribution and efficient use are largely determined by the natural, or cultivated, properties of the ground on which it falls. Of the total precipitation on the earth, speaking very generally, about

one-half is evaporated; about one-third is 'run-off', that is, it runs off over or through the ground, and, by means of the various watercourses, eventually reaches the sea ; and about one-sixth is taken up into plant structure or otherwise absorbed in process incident to growth. What is known as the 'groundwater' serves as a balancing reservoir, being drawn upon during periods of rapid plant growth or of deficient precipitation, and being replenished during seasons of plentiful supply.

The proportion of the precipitation which runs off is that which provides the water for power development, but it must be recognized this same water may also be required to furnish a supply for domestic and municipal purposes, for irrigation, for industrial and manufacturing purposes, or for navigation and fisheries.

Many interdependent and interrelated interests are primarily dependent upon water, and, consequently, keen discrimination is necessary in determining what importance shall be attached to the development of any particular water-power. The subject of power development must be treated with due consideration for the other uses for which water may be required ; therefore, in the following paragraphs water, viewed broadly as a natural resource, and the claims of other interests upon this resource, are discussed.

Run-off and Forests

Much has been written respecting the influences of forest cover upon precipitation and run-off. Some of the views expressed differ greatly, due chiefly to the fact that the authors have occupied almost entirely different viewpoints, and these they have not sufficiently defined. We shall here refer to only one or two aspects of the subject.

It has been maintained that the presence or absence of forests actually influences precipitation. For example, referring to special investigations made in North China, President Roosevelt, in a message to Congress, stated that as a result of deforestation

". . . the Mongol desert is practically extending eastward over northern China. The climate has changed and is still changing. It has changed even within the last half century, as the work of tree destruction has been consummated. The great masses of arboreal vegetation on the mountains formerly absorbed the heat of the sun and sent up currents of cool air which brought the moisture-laden clouds lower and forced them to precipitate in rain a part of their burden of water. Now that there is no vegetation, the barren mountains, scorched by the sun, send up currents of heated air which drive away instead of attracting the rain clouds, and cause their moisture to be disseminated. In consequence, instead of the regular and plentiful rains which existed in these regions of China when the forests were still in evidence, the unfortunate inhabitants of the deforested lands now see their crops wither for lack of rainfall, while the seasons grow more and more irregular ; and, as the air becomes dryer, certain crops refuse longer to grow at all."*

Irrespective of whatever opinion may be held as to the effect of forests in influencing the amount of precipitation, it is conceded that no topographic feature, generally speaking, ministers more efficiently to gradual and econo-

*Consult *Message of the President of the United States*, 2nd Session, 60th Congress, Washington, D.C., 1908.

mical run-off than do areas covered by vegetal growth, whether it be forest or such other growth as will correspondingly regulate or temper the run-off. Thus it is that failure to intelligently conserve forest areas has caused great destruction of forest floors and agricultural lands. The damage occasioned by repeated forest fires, especially if the ground is rocky and the soil cover scanty, is exceedingly bad, and contributes greatly to excessive flood run-off. The annual destruction of property by floods appears to increase rather than diminish.*

Serious floods frequently occur as a result of a heavy snowfall upon ground which has been frozen after having first been saturated with water. When this snow melts it is very apt to augment, materially, the surface run-off, because the already frozen ground precludes the usual absorption.

Occasionally, forests may even accentuate floods. When, for example, the winter's snow is retained by a forested area until late in the spring, and then a marked rise in temperature or warm rain occurs, the real net effect of the forest cover would be to accentuate flood stages. Of course, such factors as the character of the forest floor, its porosity and depth, the nature and permeability of the subsoil, and others,† all exert their influence.

In the case of water-power development, therefore, it is necessary to determine whether the advantages accruing from the industries which propose to use the water-powers will be more than counter-balanced by the disadvantages resulting therefrom. Thus, for example, wood-pulp mills, if their operation might result in practically denuding the land of forest growth, had better not be established at all; or, if established, they then should be

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*Respecting the extent of damage caused by floods, consult *Papers on the Conservation of Water Resources*, being U.S. Geological Survey Water Supply Paper No. 234; also *Descriptive Floods in the United States in 1905, with a Discussion on Flood Discharge and Frequency, and an Index to Flood Literature*, by E. C. Murphy and others, 1906, Paper No. 162.

For special discussion relating to flood prevention, etc., see *Report of Flood Commission of Pittsburg, Penna.*, which contains the results of surveys, investigations and studies made by the Commission for the purpose of determining the causes of, damage by and methods of relief from floods in the Alleghany, Monongahela and Ohio rivers at Pittsburg, Penna., together with the benefits to navigation, sanitation, water supply and water-power to be obtained by river regulation. This report contains an extensive 'Bibliography of Flood Literature,' giving bibliographies and indexes and discussions upon flood prediction, forest influence, ice and its effect, levees, reservoirs, sanitation, American rivers, foreign rivers, Pittsburg, 1912; see also, *Hearing on Floods at Pittsburg, Pa.*, before the Committee on Flood Control, House of Representatives, 64th Cong., 1st Sess., March 27, 1916, Washington, 1916; also *The Rivers and Floods of the Sacramento and San Joaquin Watersheds*, being U.S. Weather Bulletin No. 43, Washington, 1913.

For various views recently expressed respecting flood conditions and their control, consult Statement prepared and presented by the Mississippi River Levee Association, being a monograph by John A. Fox, entitled, *A National Duty, Mississippi River Flood Problem, How the Floods Can Be Prevented*, Washington, 1914; also Hearings re *Prevention of Floods on the Mississippi River*, before Sub-Committee of the Committee on Commerce, U.S. Senate, 63rd Cong., 2nd Sess., Washington, 1914, also *Supplemental Report re Floods and Levees of the Mississippi River*, submitted by Mr. Humphreys of Mississippi, being House Report 300, Part II, 63rd Cong., 2nd Sess., Washington, 1914; also *Floods and Levees of the Mississippi River*, by Benjamin G. Humphreys —Member of Congress for Mississippi—Washington, D.C., 1914; also *Hearings on Floods of the Lower Mississippi River* before the Committee on Flood Control, House of Representatives, 64th Cong., 1st Sess., March, 1916, Washington, 1916; Consult also, *Report of Consulting Engineers to the International Joint Commission Relating to Official Reference re Lake of the Woods Levels*, which report deals with the flood conditions prevailing in 1916 on the Lake of the Woods Watershed.

†Those who desire to study the effects of the various meteorological influences which modify run-off—the chief of which is evaporation—may do so by referring to works dealing specifically with hydrological phenomena.

operated under the strictest regulation and supervision, designed to perpetuate the forest growth. A deforested, eroded and scoured territory, which has lost the humus of its soil, cannot hold the beneficent rains which, instead of being retained in the ground and transmuted into plants by the various processes of growth, carry destruction in the pathways of their torrential run-off. The water is necessary to the soil, and the soil, with its plant growth, is necessary to an economical disposition of the water.

Water-power and Agriculture

Consider, next, a little more in detail, the possible effects which the depletion of underground water by diversions for power or other purposes may have upon agriculture. Underground waters are by no means inexhaustible.

Underneath the surface of the earth is a vast body of water which may be likened to an underground lake, called the *ground-water*. It has been estimated,—again speaking generally,—that the moisture in the upper 100 feet of the ground is equivalent to a lake of water some 17 feet deep, *i.e.*, the equivalent of about seven years' rainfall. It is into the upper surface, termed the *water-table*, of this ground-water that wells are sunk for domestic and other water supply. During periods of plant growth this ground-water yields, chiefly by capillary action, part of its moisture to the plants ; and then during seasons of excessive rainfall, is again replenished. Under normal conditions, the annual fluctuation in level of the water-table is but a few inches. Such states as Minnesota, Iowa, Wisconsin, Southern Michigan, and the Dakotas, have, it is stated, already experienced alarming and permanent recedence in the levels of their ground-waters, and a consequent diminution in crop production. Large sums of money have been expended by the federal and state governments in the United States, on the investigation of the occurrence and flow of underground water, and it is now being more and more recognized that proposed disposition of the run-off, and underground waters, should be considered together, because of a natural balance that exists between them.*

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*Students of sub-soil water conditions will be greatly aided by the valuable publications of the United States Geological Survey. The subject may well be opened up by referring to the following Water Supply and Irrigation Papers issued by the Survey :—*Underground Waters of Eastern United States*, 1905, No. 114 ; *Bibliographic Review and Index of Papers Relating to Underground Waters*, 1879-1904 ; 1905, No. 120 ; *Relation of the Law to Underground Waters*, 1905, No. 122 ; *Field Measurements of the Rate of Movement of Underground Waters*, 1905, No 140 ; *Underground Water Papers*, 1906, No. 160 ; *Bibliographic Review and Index of Underground Water Literature published in United States in 1905*, No. 163 ; *Underground Waters for Farm Use*, 1910, No. 255 ; *Well-Drilling Methods*, 1911, No. 257 ; *Underground Water Papers*, 1910, No. 258 (This paper contains a number of valuable monographs dealing with special features relating to underground waters.) The U.S. Geological Survey has in course of preparation an extensive bibliography and index of publications relating to sub-soil waters which it is anticipated will be ready for publication in 1918, as Water Supply Paper No. 427.

For studies on the movement of ground water consult Water Supply Paper No. 67, *The Movements of Underground Waters*, by C. S. Slichter ; also by same author, 'Theoretical Investigation of Motion of Ground Waters,' pp. 295-384 in *19th Annual Report of U.S. Geological Survey*; also 'Observations and Experiments on the Fluctuations in the Level and Rate of Movement of Ground Water on the Wisconsin Agricultural Experiment Station Farm,' etc., by F. H. King, *U.S. Weather Bureau Bulletin, No. 5*, Washington, 1892 ; also by same author, 'Principles and Conditions of the Movements of Ground Water,' pp. 59-294, in *19th Annual Report of U.S. Geological Survey*; see also, 'Studies on the Movement of Soil Moisture,' by E. Buckingham, *U.S. Department of Agriculture, Bureau of Soils, Bulletin No. 38*, Washington, 1907 ; and *Bulletin No. 64 of the Agricultural Experiment Station, University of Arizona*, being 'Ground Water Supply for Irrigation in the Rillito Valley,' by G. E. P. Smith, Tucson, Arizona, 1910.

It is easily possible to so divert some channels or water-courses as to allow much of the ground-water to be lost, and consequently cause permanent damage to a large expanse of territory. Great waste and carelessness have been manifested in many localities by the users of the underground waters. In the smaller towns, more especially in the east, where the domestic wells furnish so much of the water supply, it has frequently been observed that when some deep trench, as, for example, a cut for a new sewer or a mine shaft, has been excavated, the underground waters have drained away, thus 'bleeding' the adjacent territory and causing the wells of the neighbourhood to go dry. The lessons that may be drawn from such illustrations should not be forgotten in considering our valuable underground waters, when viewed locally or with respect to their provincial or larger areas.

Discussing the underground waters of Southern California, F. C. Finkle said:

"Much investigation has been carried on to determine the extent of the underground water supplies in Southern California. All investigators have reached about the same conclusion, that the supply produced by nature, annually, for the replenishment of these reservoirs, is limited. While it is considerable in years of abundant rainfall, it becomes almost nothing in years of minimum precipitation, and a mean must be drawn so that the reserve supply is not withdrawn to such an extent as to imperil this resource. Up to the present time this has been much neglected, and the haphazard and reckless way in which promoters have attacked the underground water supply of Southern California has demonstrated the necessity of future retrenchment. A great number of cases may be cited where one company has obtained a supply of water by underground development, soon to find that someone else would follow them and either take away a portion or all of their supply. Cases of this kind became so numerous that the matter had to be brought to the attention of the courts and much expensive litigation has been the result."*

Of this ground-water, the late Dr. W. J. McGee, secretary of the United States Inland Waterways Commission, and expert in charge of soil water investigations of the United States Department of Agriculture, states:

"It is the essential basis of agriculture and most other industries, and the chief natural resource of the country; it sustains forests and all other crops, and supplies the perennial streams and springs and wells used by four-fifths of our population and nearly all of our domestic animals. Its quantity is diminished by the increased run-off due to deforestation and injudicious farming. Throughout the upland portions of the eastern United States, the average water-table has been lowered 10 to 40 feet, so that fully three-fourths of the springs and shallower wells have failed, and many brooks have run dry, while the risk of crop loss by drought has proportionately increased, and the waste through the Mississippi has increased over 15 per cent."†

In connection with his work for the Department of Agriculture, Dr. McGee assembled the records of some 35,000 wells scattered throughout

*Newell, F. H., *Proceedings of Second Conference of Engineers of the Reclamation Service*, Washington, 1905; p. 59 (W.S. & Irr. Paper No. 146.)

†McGee, W. J., 'Water as a Resource,' in the *Annals of the American Academy of Political and Social Science*, May, *1909*; p. 46-47.

the United States, and as a result of his research has made the following statement :*

"Second in order, but first in significance, among the results of the inquiry is a clear quantitative indication that the subsoil-water level is, and has been since the settlement of the country, lowering at a considerable rate. The rate of change varies from region to region and state to state, ranging from a slight rise in irrigated districts to a lowering of about 3·5 feet per decade. In the 31 states forming the half of the country best adapted by natural conditions to feeding and clothing a great people, the average lowering since settlement would appear to be no less than 9 feet, *i.e.*, from well within, to about the limit of capillary reach from the surface. The data, indeed, indicate that lowering generally was more rapid within the first generation after settlement than later, yet the figures used in the estimates are derived from the reduced rate of the last two decades rather than the more rapid lowering of earlier decades. It would appear also that the actual loss of water attending the lowering is 10 per cent of the aggregate volume within the first hundred feet from the surface—a national loss of substance comparable with the destruction of forests and the uses and wastes of petroleum and natural gas, and far exceeding the consumption and waste of coal and metal. In the light of the relation of subsoil water to productivity, its rate of lowering can only be regarded as a measure of advancing national impoverishment."

The chief causes for the lowering of subsoil water are discussed and remedies suggested. Respecting the remedies, it is interesting to note the closing paragraph of Dr. McGee's report. He states :

"Naturally, the remedial methods can neither be adopted nor made effective in a day ; time will be required for the advance of knowledge, for the growth of sentiment, and for the development of those regulations required for successful community action. In some cases townships, in others counties, and in still others states, will necessarily act in respect to regulations suggested by local or general needs and conditions ; in some instances the regulations may relate chiefly to the control of water, in which useful lessons may be borrowed from the arid region in which water is recognized as the real source and measure of life ; and doubtless in some instances it will be found expedient to treat as a public nuisance silt-bearing water permitted to flow from an ill-wrought farm over neighbouring property—yet all such needful regulations should be foreseen, since they are bound to be made in time, else the natural value on which the productivity and habitability of the country depends will be frittered away and the new fertile acres be made desert."

In the face of such facts the claims which the ground-water supply has upon its proportion of the rainfall cannot be ignored. Certainly, watercourses and the sources of their supply should not be so disturbed as to cause a serious permanent depletion, or pollution, of the underground waters. Upon this point, therefore, it is necessary that the amounts, movements, and functions of

*For instructive discussions *re* well surveys consult the following by W. J. McGee :—'The Agricultural Duty of Water,' in the *Year Book of the Department of Agriculture* for 1910, pp. 169-176 ; 'Principles of Water Power Development,' in *Science* (New Series), vol. 34, No. 885, pp. 813-825; December 15, 1911, especially footnote on p. 5 ; 'Soil-Erosion,' *Bureau of Soils Bulletin*, No. 71, 1911 (see footnote, *Ibid.* p. 27); 'Wells and Subsoil Water,' *Bureau of Soils Bulletin No. 92*, U.S. Department of Agriculture, Washington, 1913, including 'Review of the Well Census,' pp. 178-185. Consult, also, 'Summary of the Controlling Factors of Artesian Flows,' by Myron L. Fuller, *Bulletin No. 319, U.S. Geological Survey*, Washington, 1908 ; also, for method of recording wells, see, for example, 'Record of Deep Well Drilling for 1904,' being *U.S. Geological Survey Bulletin No. 264*, Washington, 1904. Consult also, citations in footnote, *supra, re* 'Underground Waters.'

the ground-water in any district be studied in connection with any general scheme devised for the utilization of water in that particular territory. It must be evident, therefore, that efforts to have the underground waters properly and efficiently used, deserve the fullest support.

The underground waters of Canada, in some places, are now being tapped, and, not infrequently, wasted. In the United States, many states have enacted laws designed to conserve such waters. A main feature of such laws has been the regulation of the flow by actually limiting the size of the pipe through which ordinary domestic and farm water supply may be taken. Sometimes the law states that the supply shall be taken through a half-inch pipe, which shall be furnished with a stop valve. In some states the penalties for violation of the law relating to underground waters are severe ; for example, in South Dakota :

"If any person complains that the proprietor of an artesian well, or the party controlling such well, is in the habit of letting the waters go to waste, the township supervisor, county commissioner, road overseer, alderman, or other city officers, may enter upon the premises where the well is located in order to determine whether the complaint is justified, and may institute criminal prosecution in case violation of the law is ascertained. If the well is without valves to regulate the flow and prevent waste, the person owning the well may be fined up to one hundred dollars, or be imprisoned not more than three months in jail, or both."*

Laws regulating the use of underground waters are needed in Canada. At present, farmers and others are tapping these underground waters and, in some cases where 'gushers' have been struck, the valuable waters are permitted to run to waste continuously. This should not be allowed.

The British Columbia authorities are seized of the importance of this subject and the need for effective legislation and control. In 1914, an investigation was made of artesian wells, more particularly in the Fraser River flats. Referring to this investigation, Mr. William Young, Comptroller of Water Rights, says :

"Furthermore, the investigation has shown that this class of investment, practically new to this province, in well-drilling for underground water supplies and development, has, in a few years, quietly grown into a large and important enterprise, in which considerable capital has been invested and risked and important interests created mostly by individual farmers. Further, that this position has been reached without legislation or departmental control. It has been brought to the notice of the Department that several of these interests had been encroached upon, in some cases entirely destroying their value ; so that those wells which formerly gave a good supply are now going dry. It is therefore implied that this state of affairs is due to the fact that there is no control of wells nor the water flowing from them, as those which have been drilled lower down the slope are flowing and being permitted to flow, thus causing the wells above them to go dry owing to what is clearly a waste of water. From all the information gathered, this waste is due to a misapprehension in capping and controlling the flow of these wells."†

*Johnson, D. W., *Relation of the Law to Underground Waters*, Washington, 1905 ; p. 47. (W.S. & Irr. Paper No. 122.)

†*Report of the Water Rights Branch*, Victoria, B.C., for 1914, page H 8 ; see also *Ibid*. pp. 18-20 ; also report for 1915, pp. F 32-37.

Referring to the actual waste of water in certain districts, the Comptroller states :

"It should be pointed out that 101 wells in Cloverdale and Langley districts discharge a total of some 450,492 gallons per day, whilst the total requirements of the 74 interests dependent on this water amount approximately to 50,000 gallons per day. As these wells are all running uncontrolled, it can be seen that some 400,000 gallons per day are running to waste. . . . The flow of many of the wells is decreasing and nothing has been done to try and improve them."

Sufficient has now been said clearly to demonstrate the vital importance of these sub-soil waters.

The Government should require all flowing wells to be registered, along with an adequate description of each ; and it should require that all such wells be securely capped and the flow released, as required, by means of proper sized pipe and valve. Government inspection should also be provided. Whether it be federal or provincial action, it is imperative that legislative measures be enacted and the means for the enforcement of same be provided without delay.

Water-power and Irrigation

Agricultural pursuits in many parts of British Columbia cannot successfully be carried on without having water available for purposes of irrigation. In this report it is quite impossible to canvass this very broad subject.

Attention has already been drawn to the difficult problem respecting conflicting water rights with which the provincial authorities have had to deal. Between the passage of the Water Act of 1909 and the end of 1915, out of a total of over 7,000 water rights, about 3,800 rights were confirmed and 1,900 cancelled ; on Dec. 31, 1915, about 400 were pending for further consideration, 360 in favour of Indians were held over for subsequent adjudication, and about 600 had not yet been dealt with. A very large proportion of these 7,000 rights were for irrigation. In adjudicating upon them the Provincial Board of Investigation has made special effort to avoid the perpetuating of rights for water, where power interests would unduly conflict with irrigation interests, or *vice versa*.

The provincial authorities have been alive to the great advantages resulting to British Columbia through agricultural development, following the extension of irrigation. Hon. W. R. Ross, former Minister of Lands, rendered signal service by the efforts put forth through his department in connection with the fuller conservation, and application for beneficial use, of the inland waters.

In 1912, the Minister requested Dr. Samuel Fortier, Chief of Irrigation Investigations of the United States, assisted by Mr. H. W. Grunsky, to examine into and report upon the general status of the water problems with which British Columbia had to deal.* To show the importance of the use of water for irrigation, sometimes in preference to its use for power in certain parts of the province, we cannot do better than quote the authoritative statements

*See *Report of the Water Rights Branch for 1912*, article by Samuel Fortier, 'Irrigation's Part in the Future Upbuilding of British Columbia,' pp. 10-14.

of Dr. Fortier. Respecting the importance of irrigation to certain portions of the United States, he says :

"Those who have watched the rise and progress of western commonwealths must have observed how large a part of their total revenue is derived from irrigated products. Irrigated agriculture lies at the foundation of much of the material prosperity of the West. Through the agency of water wisely used, deserts are converted into productive fields and orchards, and flocks and herds and prosperous communities take the place of wild animals and an uncivilized race. It also furnishes food and clothing for the dwellers in cities, raw material for the manufacturer and traffic for the transportation company. If it were possible to remove from the arid region the comparatively small area which has been rendered highly productive by means of irrigation, it would go far to undo the labour of half a century in building up the western half of the Union."*

In referring to his examination of conditions in British Columbia, Dr. Fortier draws specific attention to the great importance of irrigation in some of the Western States. He refers more particularly to Montana, Colorado and California, and, in each instance, shows that the increasingly great annual value of the agricultural products of these states is the result, largely, of the more extended employment of irrigation. For example, he says, respecting Colorado :

"I am pointing out some of the achievements of Colorado for the purpose of calling attention to the agricultural possibilities of southern British Columbia. All the crops that are now grown in Colorado can be produced in British Columbia. Its nearness to the Pacific ocean, the presence of large bodies of inland waters, and the low altitude render it particularly well adapted to deciduous-fruit raising. The time is not far distant, I believe, when the output from the orchards of this part of the province will exceed that from all the mines. It is more than likely, however, that horticulture will be developed at the expense of other equally important branches of agriculture. The orchards of Colorado produce less than $5,000,000 annually, but the farmers receive $6,000,000 a year for sugar beets, $15,000,000 for cereals and $17,000,000 a year for alfalfa and other forage crops. Inasmuch as the climate and soil of southern British Columbia are favourable to fruit raising, no good reason can be advanced why it should not be a leading industry. At the same time, the growing of the leguminous and cereal crops should not be neglected. It will not pay, for example, to export fruit and import dairy and meat products. Such a policy would tend to enrich the railroads at the expense of both the producer and the consumer."

It is pointed out that until recently, Colorado was regarded chiefly as a mining state. It is still rich in minerals, but the wealth derived from crops and live stock now far exceeds that from the mines. The total mineral production in 1889 was a little over $33,000,000. Twenty years later the output of gold and silver had not materially increased, but the larger output from the coal-fields had raised the aggregate value to $40,000,000. No accurate statistics are available for the value of farm crops in 1889, but in the decade from 1899 to 1909 there was an increase in the value of farm crops of over $34,000,000.

In British Columbia, south of the 52nd parallel, there is a larger area than the entire state of Colorado. While this southern belt represents less than

* *Use of Water in Irrigation*, by Samuel Fortier, New York, 1915, page 1.

one-third of the area of the province, it is by far the most valuable from an agricultural point of view, and comprises the bulk of the land susceptible to irrigation and where the most valuable crops will be raised in the future. There is an increasing tendency to employ some irrigation even in districts where the precipitation usually has been considered sufficient. Dr. Fortier gives his opinion that "As time goes on, and a larger area is intensively farmed, I believe the need of supplementing the annual rainfall by irrigation in all these districts will be more keenly felt. In other words, many of the districts which are now thought to possess sufficient rainfall will be, in part, irrigated. At least, this has been true of localities to the south." Referring to Montana, Colorado and California, he continues, "These, and many other cases which might be cited, show that the practice of irrigation is spreading rapidly in the United States, and that the localities in which the annual rainfall was considered ample ten or fifteen years ago are now largely dependent on irrigation for their supply of soil-moisture."

In certain districts, the inadequacy of the water supply itself, limits the extent to which suitable land may be brought under irrigation. Respecting this aspect of the subject, Dr. Fortier has stated :

"The amount of the available water-supply is the standard by which we measure the ultimate production of arid and semi-arid lands. Even now we can look forward to the time when California, with its abundant natural resources, will be greatly handicapped by reason of the lack of water. Out of something like 21,000,000 acres susceptible of irrigation, there is only water enough for 10,000,000 acres. Colorado is credited with a larger area of arable land, but it is doubtful if more than 6,000,000 acres can ever be irrigated. The extent of arable land in Montana is quite as large, but all the available water-supply is likely to be exhausted when 5,000,000 acres are watered. Water in the west needs to be conserved perhaps more than any other natural resource."

A thorough appreciation of the dependence of water-power and agriculture upon the water supply, as above outlined, will permit a better understanding of certain rulings that may be made by the provincial authorities in their efforts to make the best possible apportionment of the available water supply.

In some instances it may be possible more nearly to approach ideal conditions in the conserving of the water supply so that it may serve a number of interests. This may even be accomplished in the case of watersheds, the hydrological conditions of which may, upon casual inspection, appear rather unpromising.

For example, the Santa Ana, an important stream traversing Southern California, has a total drainage area of between 1,800 and 1,900 square miles, of which about two-thirds is in the valley, and only a few hundred square miles yield much run-off. It rises in the heart of the San Bernardino mountains and flows westward for about 25 miles to the mouth of its upper cañon, thence southwestward, across the San Bernardino valley, through the lower cañon to the Santa Ana mountains, and across the Coastal plain, to the Pacific.

Irrigation in the valleys of the Santa Ana basin has attained a very high state of development, and the Santa Ana waters have been made to serve

greater and more varied uses than probably any other stream of its size in the United States. The authors of the comprehensive report upon the *Water Resources of California* state, respecting the use of the Santa Ana waters :*

"To begin with, a portion of the flow is regulated by artificial storage in the upper part of the basin, and the water passes successively through three hydro-electric plants before reaching the mouth of the cañon.

"On leaving the lower plant, it is turned into high-level canals and used for municipal supply and irrigation about Redlands and Highland.

"The irrigation water that escapes through seepage to the body of ground water is recovered from springs and flowing wells, and from pumped wells, and is used for irrigation around San Bernardino and Riverside, the power for pumping being generated on the upper reaches of the stream.

"Bedrock obstructions at Riverside Narrows, below the city of Riverside, force to the surface a part of the water in the gravel bed of the stream above this point, and this water, after being diverted for power development, is returned to the river above Corona.

"Only a few miles below, it is again diverted and used for irrigation on the Coastal plain in the vicinity of Santa Ana and Anaheim.

"The seepage water from irrigation is once more recovered by numerous pumping plants and flowing wells on the lower Coastal plain west of Santa Ana."

In passing from mountain to sea, a distance of not more than 100 miles, the same water is used at least eight times for power and irrigation. In like manner the water in many of the tributaries is used several times before reaching the main stream.

It is along somewhat similar lines that British Columbia must seek, wherever possible, to obtain the maximum benefit from her mountain streams. Anyone who knows what has already been accomplished through the agency of irrigation in the Okanagan and Kootenay districts, as well as in other portions of the province, does not require further demonstration of the excellent results which follow the intelligent application of water to the fertile soil of the arid and semi-arid agricultural regions of British Columbia.†

The Premier of British Columbia has stated that it is the policy of his province to secure the greatest efficiency from the use of its waters. He said : "If it be for the purpose of irrigation, let every inch of water do its duty, and, if it be for the purpose of power, let us see that the works are so carried out as to get from the investment and from the water conservation, the very best and most profitable results." ‡

Power for pumping water for irrigation may be furnished by many of the provincial streams. Lying alongside some of the main rivers, there are considerable areas of bench lands to which water cannot economically be conveyed by gravity. In some cases, the employment of high tension transmission may enable hydro-electric power to be supplied, even from distant sources, at suffi-

*For facts here stated and for descriptions of what has been accomplished in the use of water in California, consult *Water Resources of California*, by H. D. McGlashan and H. J. Dean, being U.S. Geological Survey Water Supply Paper No. 300 ; also Papers Nos. 298 and 299.

†See *Annual Reports of Minister of Lands*, Victoria, B.C., especially the reports of the Water Rights Branch ; also consult *Irrigation in British Columbia*, by B. A. Etcheverry, being Bulletin No. 44, Department of Agriculture, British Columbia, Victoria, 1912.

‡See *Report of Select Standing Committee on Forests, Waterways and Water-powers*, Ottawa, 1914.

ciently low rates to be used for electric pumping. Some of the water derived from many snow- and glacier-covered areas may thus, indirectly, be utilized to irrigate land and thereby bring into beneficial use both water and land that might otherwise remain unproductive.

Irrigation tends to the permanent settlement of the country. Consequently, in the majority of cases, the use of water for irrigation will result in more widespread benefit than if otherwise used. Special care should, therefore, be taken to ensure that in granting 'water records,' water is not diverted for power which might more advantageously be used for irrigation—a use which may further the settlement and development of larger sections of the country.

Water-power and Navigation

From the earliest times, inland waterways have constituted the most important means of communication to the interior. In a mountainous country, such as British Columbia, the inland water-ways are more frequently interrupted by rapids, cañons and falls, which prevent continuous navigation ; but, on the other hand, the great difficulty and expense of constructing roads and railways through such rugged territory considerably enhance the value of the navigable portions. These, when used in conjunction with short connecting railways, may sometimes provide access to large areas.*

The importance which some authorities attach to the conservation of water, to the end that it may serve the interests of navigation prior to those of power, is well illustrated by the following statement, made in connection with the policy announced by the International Waterways Commission :

"The Joint Commission had agreed, as one of the principles which should govern the use of boundary waters, that, where there could be temporary diversions, without injury to the interests of navigation, for the purpose of developing power, they should be allowed. . . . The paramount right to use the great water system, starting with lake Superior, and finding its way by the St. Lawrence to the sea, is for navigation purposes . . . "†

Again, referring to the water rights of the St. Mary river, the international waterway bordering Michigan, the United States Federal Act of March 3rd, 1909 (Public Acts, No. 317), states that these waters

"shall be forever conserved for the benefit of the Government of the United States, primarily for the purposes of navigation and incidentally for the purpose of having the water-power developed, either for the direct use of the United States, or by lease or other agreement through the Secretary of War. . . . Provided, that a just and reasonable compensation shall be paid for the use of all waters or water-power now or hereafter owned. . . . "‡

The International Boundary Waters Treaty between Great Britain and the United States, ratified in 1910, provides rules and principles which govern the International Joint Commission in determining the order of precedence which shall be observed in the disposition of water privileges. Article VIII states that

*Respecting the early use of the rivers of British Columbia by explorers and others, consult publications relating to exploration, travel and history mentioned in the Bibliography. See Appendix.

†*International Waterways Commission*, Supplementary Report, 1907 (Ottawa, 1908), p. 12. See also Chairman's remarks.

‡See *Ibid.*, p. 21.

Plate 2

FALLS AND RECENTLY CONSTRUCTED FISHWAY ON MEZIADIN RIVER

Entrance to the fishway is at foot of main falls. It has a width of not less than 25 feet and a depth of 6 feet at low water. Upstream end of fishway is 20 feet wide and 3 feet deep at low water. A wing-dam of logs and rock, built at an angle of 45 degrees to the bank, prevents drift entering the fishway. The Meziadin is a tributary of the Nass.

Copyright, Courtesy Mr. John P. Babcock.

OBSTRUCTIONS ON SALMON RIVERS

These may be a very serious menace to fishing interests. Illustration shows adult Sockeye of the 1913 run forced—by a rock slide caused by railway construction along the Fraser cañon in 1912—into the mouth of Spuzzum creek, a tributary to the Fraser below the obstruction

"The following order of precedence shall be observed among the various uses enumerated hereinafter for these waters, and no use shall be permitted which tends materially to conflict with or restrain any other use which is given preference over it in this order of precedence :

"(1) Uses for domestic and sanitary purposes

"(2) Uses for navigation, including the service of canals for the purposes of navigation

"(3) Uses for power and for irrigation purposes."

From the foregoing, it is evident that power possibilities, under certain circumstances, have been regarded as of less, or as of only incidental, value when compared with the interests of navigation.

Continued deforestation and devastation wrought by forest fires are factors which materially reduce the uniformity of the annual run-off, so that low-water conditions as affecting navigation may become more and more serious, and, in turn, demand an increased utilization of storage for navigation.

Navigable Inland Waters of British Columbia

In British Columbia there are numerous lakes* and many stretches of river which are navigable. By a navigable stream is here meant one which can be navigated by the ordinary flat-bottomed river boat, generally a stern-wheeler. On many of the lakes, steamers of larger size can be used, whilst some swift-flowing rivers, not navigable by stern-wheelers, may be ascended by fast motor craft of shallow draught. There are stretches, not at present navigable, which may be made so by the construction of suitable works. The erection of dams and other works for power development will, at a number of places, improve the rivers for navigation, both by drowning out rapids and by increasing the depth at shallow places. Lockage provisions in all dams should, of course, be fully safeguarded.

The following is a brief summary of the principal navigable portions of the inland waters of British Columbia. There are, of course, in addition, numerous inland lakes which afford certain navigation facilities.

COLUMBIA RIVER WATERSHED—*Columbia river* is navigable from Northport, ten miles south of the international boundary, through the Arrow lakes to Laporte, above Revelstoke, a total distance of about 210 miles. The season extends from May to September, but the Arrow lakes are navigable all the year. Ice forms in the narrows between the lakes, but the channel, which at low water is shallow and somewhat crooked, is kept open by an ice-breaker. The Canadian Pacific steamers operate between Arrowhead and West Robson, about 120 miles. Some difficulty is experienced in the cañon above Revelstoke. In the past, small craft were frequently worked upstream as far as 'Boat Encampment,' at the mouth of Wood river. The upper Columbia is navigated from Golden to Columbia lake, 90 miles, from May to October. *Okanagan lake* is navigable for the length of the lake, 67 miles. On the *Kootenay River system*, Kootenay lake, 66 miles, and its west arm, 20 miles, are navigable all year. At the 'narrows,' near Proctor, the depth at low water is only about eight feet. Kootenay river, from Kootenay lake to the international boundary, 22 miles, and thence south to Bonners Ferry, Idaho, is navigable from May to September. It is also navigable from Canal flat, at the source of the Columbia, to Jennings,

*For reference to lakes of the province and list, see pp. 40 to 45.

Montana. Before the construction of the Crowsnest Ry., steamers plied from Fort Steele, East Kootenay, to Jennings, about 60 miles. Slocan lake is navigable for 25 miles ; it is very deep, has warm springs and never freezes over.

FRASER RIVER WATERSHED—*Fraser river* is navigable all the year from its mouth to Chilliwack, 60 miles, and from May to November is navigable from Chilliwack to Yale, 40 miles. The Fraser is also navigable from Soda Creek to Tête Jaune, about 330 miles, from May to September. A regular steamer service is maintained during the open season from Soda Creek to Prince George, 130 miles. The chief difficulties to navigation in this stretch are Cottonwood and Fort George cañons, both of which have been improved. Above Prince George the river is difficult, especially at the Grand rapids, and navigation is only possible during high water. Traffic on this portion of the river reached its zenith during the construction of the Grand Trunk Pacific Ry., but, on its completion, this river transport became unprofitable, as the current is frequently fast, and the channel tortuous. *South Thompson River system* is navigable during May to October from Kamloops lake to Enderby, on the Shuswap river. The various navigable lengths, including the lakes, aggregate some 175 miles. Adams river is navigable for the length of the lake, 40 miles. *North Thompson river* is navigable from Kamloops to Mad river, 80 miles, during May to August, and navigable, also, in certain stretches above. *Nechako river* is navigable during June, July and August from Prince George to head of Fraser lake, about 110 miles. There are several bad rapids and shallows on the lower Nechako and the discharge of Fraser lake carries very little water at low stages. The Nechako watershed contains several lakes which, with short connecting railways, might provide communication to certain sections of the interior. Small launches ply on François lake. *Stuart river*, from its confluence with the Nechako to Stuart lake, including the lake, affords, at high stages only, usually June and part of July, about 100 miles of navigation.*

VANCOUVER ISLAND—The navigable portions of the inland waters of Vancouver island are practically confined to the various lakes. The west coast, however, is broken by a number of inlets, which constitute good harbours and afford access to large areas.

MAINLAND PACIFIC COAST—Along the Pacific coast, only a few of the largest rivers are navigable by stern-wheelers, although several other streams may be ascended, at some risk, by small motor craft. Between the Fraser and the Skeena, there are no streams navigable by stern-wheelers for more than a mile or two above tidal influence, which, as a rule, does not extend very far from the mouth. *Skeena river* is navigable from May to October from its mouth to Kispiox, a distance of 150 miles. The river generally opens the last week in April or the first week in May. Ice begins to run early in November, and the river usually does not freeze over until the end of December.

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*It has been stated that the Stuart River system might be improved so as to provide a navigable waterway to the head of Tacla river, a distance of 180 miles from its confluence with the Nechako. There is beached on Tremblay lake, part of the hull and machinery of a stern-wheeler, about 70 feet long. This boat, appropriately named 'The Enterprise,' made a trip from Soda creek to Tacla lake, about 1871, during the Omineca gold rush. See ***Report of the Minister of Lands***, British Columbia, 1912, page 334.

The chief obstacle to Skeena navigation is the Kitsalas cañon. The paralleling of the river by the Grand Trunk Pacific Ry. rendered water transportation on the Skeena unprofitable. Babine lake is navigable for 100 miles. *Nass river* is navigable from its mouth to the cañon, about 30 miles. *Stikine river* is navigable for about 100 miles, from the mouth to Telegraph creek, from May to September. The river generally opens for navigation between April 20 and May 1. Ice or 'sludge' usually begins to run about November 1, and at Telegraph creek the river generally freezes over about the end of November. The chief obstacles in its navigation are Little cañon and Grand rapid. Between Telegraph creek and Glenora, 12 miles, navigation is also difficult.

Mackenzie River Watershed—Peace river is navigable during the open season from the interprovincial boundary to Hudsons Hope, at the foot of Rocky Mountain cañon, 80 miles. Above the cañon, it is navigable to the confluence of the Parsnip and Finlay rivers, 75 miles. There are, however, in this stretch some bad rapids. *Finlay river* is navigable during the open season in that portion which lies in the Intermontane valley, a distance of about 140 miles, the only serious obstacle being Deserter cañon, about 90 miles from the mouth. Liard river is navigable from the interprovincial boundary to Hellgate, about 85 miles, during the open season, and its tributary, the Fort Nelson river, is navigable during the open season from its mouth to Fort Nelson, about 100 miles, also, possibly, for some distance above.*

The principal inland waters of British Columbia consist of but a few great river systems. Any works of construction or improvement relating to these rivers may readily be considered, and should be considered, in connection with their possible effects upon the rivers as a whole.

In France and Germany, where efficient systems of waterways are in successful commercial operation, before the improvement of a river or harbour is undertaken, a careful study is made of the proposed work, its cost, the time necessary for comp[illegible] the probable traffic, and of other cognate factors. When the investiga[illegible]ompleted and the project approved and adopted, provision is then mac[illegible] the entire expenditure.

In British Columbia, and, indeed, throughout Canada, the same caution should be exercised. While much water-borne traffic has been absorbed by the railways, water traffic still has its important place. In connection with the construction of power dams or other structures in streams, care should be exercised that navigation be not impaired ; also, that expenditures for so-called navigation are not incurred when, in reality, the improvements are only sought for the resultant water-power.

Senator Theodore E[illegible]ton, formerly Chairman of the U.S. National Waterways Commission, and who has given special attention to waterway problems in the United States, has drawn attention to many very serious losses which the United States people have incurred through injudicious

*For a discussion of the navigable stretches of the Mackenzie river and its tributaries in Northern Alberta and the Northwest Territories see *The Unexploited West*, by Ernest J. Chambers, Dept. of Interior, Ottawa, 1914. Consult, *Mackenzie River* (Senate Report). See Bibliography.

Consult also *Port Directory of Principal Canadian Ports and Harbours*, Dept. of Marine and Fisheries, Ottawa, 1913-1914.

expenditures of money in so-called river improvements. He cautions against yielding to the importunities of those who would exploit inland water resources according to their own desires. He recently stated :

"Certainly among the most captivating, plausible and convincing groups of citizens who ever come to Washington are the 'booster clubs,' and 'boomers,' who go there with rivers to improve, and locks and dams to build, at government expense. Zest, importunity and ability to accomplish an end in view are nowhere better illustrated in this land than in the success of a waterway association seeking a Congressional appropriation."

Water-power and Fisheries

Serious consequences to the fishing resources result from obstructions which prevent the free passage of salmon and other fish.* This subject is vital in its bearing upon power development, and yet it is frequently passed over.

Practically all of the Pacific Coast streams of British Columbia and their tributaries are annually frequented by vast numbers of Pacific salmon, consequently the salmon fishing industry is one of the most important interests to be safeguarded in the carrying out of works which will materially affect the inland waterways.

There are two main features to the problem of safeguarding the fishing interests in connection with power development : *First*, to permit a sufficient number of adult salmon satisfactorily to pass all obstructions in order to reach and deposit their ova upon the spawning beds of the streams ; and *second*, to ensure that the young salmon are afforded a satisfactory passageway out to the sea.

In 1895, the province granted to a mining company the right to construct a dam at the outlet of Quesnel lake,† but no provision was made for the passage of the salmon through the dam. The result was that, following the completion of the dam in 1898, the salmon were denied access to the spawning grounds of Quesnel lake and, without having spawned, perished in countless thousands in the river below. Sufficient gold was not found to warrant a continuance of mining operations, and hence the gates, which had been closed for a part of two seasons, were opened. This provided sufficient water to permit the salmon to reach the head of the river but, owing to the strong currents at the sluiceways, did not permit ingress of salmon to the lake, and hence for five years the fish continued to mass and die below the dam, while the spawning beds of Quesnel lake remained barren of sockeye salmon. In the 'big year' of 1901, the run to the Quesnel river was very large, but, owing to the failure to provide a fishway, the spawning grounds of the lake remained unseeded that year. The pack of 1905 was 500,000 cases less than in 1901, and has commonly been attributed to the failure to seed the beds of the Quesnel in 1901. In 1903, the Provincial Government constructed a fishway, and, in 1905, several million sockeye undoubtedly entered Quesnel lake, and the large spawning area apparently was well seeded. The run of sockeye in 1909 was

*See *Fishways in the Inland Waters of British Columbia*, by Arthur V. White, published by Commission of Conservation, Ottawa, 1918.

†See Plate 23.

believed to have exceeded that of any former year, and it has been estimated that 4,000,000 adult sockeye salmon entered Quesnel lake through this fishway.*

During the construction of the Canadian Northern Ry., a very serious blocking of the Fraser river occurred in 1913 and 1914, due to a rock slide in the cañon above Yale. The slide produced currents and eddies of such character as resulted in the holding back of millions of salmon. This obstruction was more serious than that at Quesnel lake, as it affected a larger area. Reports from the various spawning grounds showed that the run reaching the grounds in 1913 was much below that of former big years. At Quesnel lake, where facilities existed for making an accurate estimate, only about 550,000 salmon passed through the fishway, as compared with 4,000,000 in 1909. The massing of the salmon below the obstruction in the Fraser is well illustrated on Plate 2.

In Canada both federal and provincial legislation has been enacted to safeguard the inland fisheries and to provide for the construction of fishways. The chief difficulty, however, as far as fishways are concerned, is that too frequently proper fishways are not provided, and that such as are provided are allowed to fall into disuse. The Dominion Fisheries Act† explicitly provides that fishways shall be built wherever the Minister of Marine and Fisheries determines they are necessary.

The British Columbia Water Act, 1914, sec. 35, provides that: "Proper provision shall be made by every licensee to the satisfaction of the Comptroller . . . For the erection and maintenance by the licensee of a durable and efficient fishway in the stream or other waterway affected by the works."‡

Water-power development may also conflict with fishing interests by the destruction of spawning grounds through the manipulation of the levels of lakes used as storage reservoirs. When lake levels are raised the margin of the lake, up to the proposed flowage line, should be stripped of tree growth and underbrush, to facilitate the formation of new beaches and maintain the healthy condition of the water. Here, again, the question of clearing becomes one of weighing advantages and disadvantages, but it is doubtful if any of the supposed advantages derivable from power development will offset the destruction of the source of one of our important supplies of food. Certainly, with intelligent regulation and forceful administration, the streams of the province should not only continue to produce vast numbers of salmon, but the supply may be greatly increased. In fact, our supplies must be increased. Recording their conclusions, some of the members of the special committee appointed to investigate the fishing industry of the State of Washington report:

"We find that civilization and all of the activities of civilization have a very serious effect in diminishing the natural propagation of fish. We find that young fish that are hatched in rivers, tributary to irrigation ditches, in their journey to the sea, are led, to a large extent, into irrigation canals and are thus destroyed. We find also that the sawdust from the mills, both in salt and fresh waters, is destructive of the young salmon and to the salmon eggs,

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*See *Annual Report of the Commissioner of Fisheries*, British Columbia, 1909, pp. 1-13.

†The Fisheries Act, 1914, R.S., c. 45, s. 1.

‡The British Columbia Water Act, 1914, section 35.

and that various other agencies of modern civilization tend to the destruction of the young fish before they reach their maturity."*

In view of the facts above presented, it is evident that no development for power or irrigation should be permitted on any of the salmon streams without fully safeguarding the fishing industry.

Inland Waters and Mining

The British Columbia laws relating to water clearly reflect the marked influence which the mining industry has exerted upon the use of water in the province. Mining, in point of value of annual production, has long been British Columbia's most important industry, although, during recent years, its forest products have sometimes exceeded its mineral production.

The gold discoveries of the 'fifties' necessitated the use of water for placer mining. From 1858 to about 1880, this form of mining constituted the chief branch of the mining industry. Between 1860 and 1868 the average annual value of gold exceeded $3,000,000, reaching its maximum, nearly $4,000,000, in 1863. During the decade 1906-15, the production of placer gold averaged only about $600,000 annually, but there are good prospects of the industry reviving. The total value of placer gold produced to 1915 was about $74,000,000. About 1893, lode mining for gold commenced, and, from 1908 to 1915, it averaged over $5,000,000 annually, with a total production to 1915 aggregating nearly $87,000,000.† Since 1895, there has been a remarkable growth in the production of various minerals. The production of gold, silver, lead, copper and zinc in 1895 was valued at less than $2,500,000, but, in 1915, it had increased to almost $20,000,000. The total value of the mineral products of the province for 1915 was about $29,500,000, and during the previous decade averaged nearly $27,000,000 annually.‡ These figures demonstrate the magnitude and great importance of the mining industry of British Columbia.

Water and water-power have played a most important part in mining development. Without such power as is supplied by the West Kootenay Power and Light Co. the great mining development which has taken place in the southern portion of the province would have been impossible. Large plants have also been established on the Pacific coast, such as those of the Britannia Mining and Smelting Co., at Howe sound, and of the Granby Consolidated Smelting and Power Co., at Observatory inlet. There are also other, though smaller, hydro-electric plants situated at various mining centres throughout the province, such as those of the Hedley Gold Mining Co., on the Similkameen river, which are contributing materially to the advancement of mining operations. It is interesting to note that the hydro-electric plant of the Canadian Collieries, on the Puntledge river, V.I., has been erected practi-

**Twenty-second and Twenty-third Annual Reports of the State Fish Commissioner*, State of Washington, Department of Fisheries and Game, 1911-1912, p. 36.

†The increase in gold from lode mines is due, in part, to the increased output of copper. About 75 per cent of the gold production of the province is obtained from the smelting of copper-bearing ores. The production of copper in 1915 was about 57,000,000 pounds, having a value of over $9,800,000.

‡In 1916, it reached $42,290,462, due largely to the tremendous demand for munition metals and the high prices secured. For statistics respecting the mining industry of the province consult *Annual Reports of the Minister of Mines*, British Columbia, also *Lands, Fisheries and Minerals*, Commission of Conservation, Ottawa, 1911.

cally at the pit mouth of one of British Columbia's largest coal mines, thus indicating that hydro-electric power has here successfully competed with cheap fuel. In the future, doubtless, the greatest advances in mining in British Columbia will be dependent upon there being available ample water-power or hydro-electric energy, and probably, many of the smaller and less accessible undeveloped water-powers will be most profitably utilized in connection with mining operations.

In Eastern Canada, as well as in Eastern United States, industries dependent upon electric energy for refining metals are realizing that, before long, they may require to remove to localities where cheap power is available. In the more settled portions of the country, power is no longer obtainable at low rates, inasmuch as it is now required for municipal, domestic and light manufacturing purposes, which yield a much larger return.

Sufficient has been said to indicate the dependence of the mining industry, both for placer and lode mining, upon the inland waters of the province ; indeed, experience has demonstrated the fact that the gold output from hydraulic mining is practically proportioned to the number of days upon which water is available.

With respect to the disposal of tailings and waste, every reasonable precaution should be taken to ensure against the serious blocking of channels by deposits. Accumulations of tailings are frequently washed out by freshets and ruin valuable agricultural lands. To a lesser extent, these comments apply to the ordinary dumps from lode mines. The sites for dumps should be carefully selected, with reference to the preservation of the purity of the streams. Also, streams should not be polluted by chemical or other waste products in such manner as to render the water unfit for other profitable uses.

Pollution of Inland Waters

The pollution of New York harbour, Toronto harbour, the Great lakes and the Ottawa river, and the pollution, by summer travel, of inland waters, like those of the Muskoka district, demonstrate the need to safeguard British Columbia's inland waters against similar pollution. No effort should be spared to prevent the pollution of waters by domestic sewage and industrial wastes.

Those upon whom it devolves to provide domestic and municipal water supplies should have their hands strengthened in every reasonable endeavour to safeguard waters which are present or potential sources of supply for the growing cities, towns and villages of the province. The great and increasing pollution of waters, rendering them unfit for necessary uses, will, in the future, demand more serious attention than has hitherto been given it.*

The effects of sewage upon waters into which it has been turned may be studied through many valuable publications and reports. Conclusions based

*In 1913, a Committee of the Senate considered the subject of pollution of inland waters. For their deliberations and conclusions consult : *Proceedings and Evidence of the Select Special Committee on the Pollution of Navigable Waters* (revised edition), Ottawa, 1913 ; see also, 'Draft Bill of Dominion Pollution Health Conference *re* Pollution of Waterways,' p. 167 of *Second Annual Report of the Commission of Conservation*, Ottawa, 1911 ; see also Reports upon the Pollution of International Waters, issued by the International Joint Commission. For titles of same see page 7 of *List of Decisions, Reports, etc., of the International Joint Commission*, Washington, 1916.

upon the testimony of the consulting sanitary experts in the matter of the pollution of boundary waters between the United States and Canada are below summarised. Many of them are pertinent to waters other than so-called boundary waters.

The résumé of the sanitary experts is signed by George W. Fuller, Earle B. Phelps, George C. Whipple, W. S. Lee and J. T. Lareniere. F. A. Dallyn submitted a minority résumé.*

"1. Speaking generally, water supplies taken from streams and lakes which receive the drainage of agricultural and grazing lands, rural communities, and unsewered towns are unsafe for use without purification, but are safe for use if purified.

"2. Water supplies taken from streams and lakes into which the sewage of cities and towns is directly discharged are safe for use after purification, provided that the load upon the purifying mechanism is not too great and that a sufficient factor of safety is maintained, and, further, provided that the plant is properly operated.

"3. As, in general, the boundary waters in their natural state are relatively clear and contain but little organic matter, the best index of pollution now available for the purpose of ascertaining whether a water-purification plant is overloaded is the number of *B. coli* per 100 cubic centimeters of water expressed as an annual average and determined from a considerable number of confirmatory tests regularly made throughout the year.

"4. While present information does not permit a definite limit of safe loading of a water-purification plant to be established, it is our judgment that this limit is exceeded if the annual average number of *B. coli* in the water delivered to the plant is higher than about 500 per 100 cubic centimeters, or, if in 0.1 cubic centimeter samples of the water, *B. coli* is found 50 per cent of the time. With such a limit the number of *B. coli* would be less than the figure given during a part of the year and would be exceeded during some periods.

"5. In waterways where some pollution is inevitable and where the ratio of the volume of water to the volume of sewage is so large that no local nuisance can result, it is our judgment that the method of sewage disposal by dilution represents a natural resource and that the utilization of this resource is justifiable for economic reasons, provided that an unreasonable burden or responsibility is not placed upon any water-purification plant and that no menace to the public health is occasioned thereby.

"6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

"7. The nature of the sewage treatment required should vary according to the local conditions, each community being permitted to take advantage

*Concerning Mr. Dallyn's minority résumé, the Chief Sanitary Expert, Dr. A. J. McLaughlin, states: "Mr. Dallyn's revision of the résumé report is not essentially different from the original. He insisted on the elimination of paragraphs 5, 7 and 11, which he considered to be an expression of self-evident facts and substituted monthly for yearly averages in determining the number of *B. coli* per 100 cubic centimeters of water."

Paragraph 8 of Mr. Dallyn's résumé reads : "Disinfection or sterilization of the sewage of a community should be required wherever there is danger of the boundary waters being so polluted that bathing beaches, summer resort waters, and the load on any water purification plant becomes greater than is in the interests of public health."

To compare differences in the two résumés, consult ***Résumé of Testimony of Consulting Engineers in the matter of the Pollution of Boundary Waters.*** Conference held in New York City, May 26-27, 1914. Washington, 1914.

Snow slides at the headwaters of Sinclair creek. Upper Columbia valley.

Timber debris — the result of a snow slide.

Snow slide across Sinclair creek — a closer view.

LOG JAMS CAUSED BY SNOW SLIDES OR BY THE ACCUMULATION OF LOGGING REFUSE MAY BE A SERIOUS MENACE

of its situation with respect to local conditions and its remoteness from other communities, with the intent that the cost of sewage treatment may be kept reasonably low.

"8. In general, the simplest allowable method of sewage treatment, such as would be suitable for small communities remote from other communities, should be the removal of the larger suspended solids by screening through a one-fourth-inch mesh or by sedimentation.

"9. In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such ozidizing processes as intermittent sand filtration, and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

"10. Disinfection or sterilization of the sewage of a community should be required wherever there is danger of the boundary waters being so polluted that the load on any water-purification plant becomes greater than the limit above mentioned.

"11. It is our opinion that, in general, protection of public water supplies is more economically secured by water purification at the intake than by sewage purification at the sewer outlet, but that under some conditions both water purification and sewage treatment may be necessary.

"12. The bacteriological tests which have been made in large numbers under the direction of the International Joint Commission indicate that in most places the pollution of the boundary waters is such as to be a general menace to the public health should the water be used without purification as sources of public water supply or should they be used for drinking purposes by persons travelling in boats.

"13. It is our judgment that the drinking water used on vessels traversing boundary waters should not be taken indiscriminately from the waters traversed, unless subjected to adequate purification, but should be obtained preferably from safe sources of supply at the terminals.

"14. While recognizing that the direct discharge of fecal matter from boats into the boundary waters may often be without danger, yet in the interest of effective sanitary administration it is our judgment that the indiscriminate discharge of unsterilized fecal matter from vessels into the boundary waters should not be permitted."

It is also of the utmost importance that the percolating and underground waters be conserved against pollution. Careful investigation has shown that the pollution of the local sources of water supply for factories and farms is more widespread than is usually assumed. Dr. W. T. Connell, Professor of Bacteriology, Queen's University, has drawn attention to the serious condition of many of such sources of water supply. His statements well illustrate conditions which exist scattered through the whole country. Dr. Connell said :

"Another subject to which considerable attention has again been given, is that of water supplies at factories and at farms. During the past year over two-thirds of such samples submitted have proven to be infected with dangerous forms of bacteria. I class as dangerous, forms which can be traced as originating from the intestinal discharges of animals or man, or, in the case of factories, as coming from factory drainage. Of course, it must be remembered that I am only sent samples which have fallen under suspicion, so that my figures do not represent the average condition of the farm and factory wells in

Eastern Ontario. Still I think I can state that quite one-third of the wells at farms and factories are so situated as to be open to pollution from surface drainage or from seepage from manure piles, stables, or pig-pens, or from house-wastes."

What is true of pollution in local conditions may become correspondingly true over larger areas if proper regulation is not exercised respecting the disposal of waste where it is dealt with on a larger scale.

Pollution by Factory and Industrial Wastes

Special precautions must be exercised to insure that industrial wastes are not permitted to foul inland waters and harbours. Very serious results may follow pollution by waste products emitted from industries utilizing power from these waters. Industrial waste products which destroy life in the waters into which they are turned must be regarded seriously in their probable influences upon human life.* The deposit of sawdust, mill refuse and crusher sand in the harbours and inland waters of British Columbia may become a fruitful source of pollution. Apart from its effects upon navigation, it smothers the foods for various kinds of fish, and other forms of aquatic life.

It is, indeed, anomalous to find mill operators casting saw-dust or other refuse from their mills into a river, or harbour, while, at the same time, public money is being expended upon dredging operations to remove such deposits, and thereby afford an entrance for shipping. British Columbia harbours and inland waters require protection against such abuses.

Inland Waters and Lumbering

Quite apart from questions respecting the specific effects of deforestation upon precipitation and run-off, every precaution should be taken to prevent the accumulation in streams of logging waste and other wood debris. Such material causes serious log jams, some of which have resisted all efforts to dislodge them by heavy blasting. Such debris is a serious menace to bridges and public highways, to water-power developments and to log driving. It gets into stop-log and other sluices, lodges about the intakes of water flumes, and jams against booms and the crests of dams. For views showing the character of some of these log jams, see Plate 3.

Considering its extensive area of about 360,000 square miles, British Columbia is but sparsely settled, and, consequently, there has not yet been much manifestation of some conditions met with in the older and more densely settled portions of the country. The province will do well to profit from some of these special conditions experienced in connection with lumbering operations in Nova Scotia. Referring to the effects of deforestation, Hiram Donkin, Road Commissioner of that province, states, in his report for 1909, that :

"It is of the utmost importance in the construction of small bridges that, in future, ample allowance be made in the span of the structures, to provide against conditions arising from the fact that, as the country becomes cleared up, or denuded of timber, the rainfall must of necessity flow to the streams more quickly and the freshets become more severe."

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*Citations of publications which set forth the effects of pollution by certain chemical and industrial waste products will be found on page 9 of *Water-Powers of Canada*, Commission of Conservation, Ottawa, 1911. Consult also, B.C. "Water Act, 1914," section 47 (3).

In the same report, Assistant Commissioner James W. Mackenzie, writes that:

"It seems to have been the custom for years, as wood became scarce, to narrow up and confine the streams in smaller vents. If it is a fact that the clearing up of the country is the cause of the water running off suddenly in case of heavy downfalls, our bridges must be enlarged to carry the increased streams, and this has been my experience during the last twenty years . . . .

"The most destructive summer freshet experienced in the counties of Antigonish and Pictou for the last twenty years, was the freshet of August 2nd, 1908. Some forty-six bridges in Antigonish county and fifty-six in Pictou were carried out, and in some sections every structure in wood was cleaned away. I took particular notice that, where the lumber trimmings had been thrown into the stream, the destruction was the greatest."

In a letter dealing with these matters, Mr. Mackenzie states that:

"Wherever the streams passed through cultivated lands, the bridges escaped destruction, but where they passed through wooded lands, culled over by lumbermen, boughs, trimmings of trees, brush and sticks of every description, logs, etc., were carried down, forming jams at every turn, and carrying away all the bridges."

From the foregoing it will be appreciated that British Columbia, with its extensive commercial timber resources, will do well to devise means by which such losses as those just outlined may be avoided.

Log Driving and Boulders

The beds of many rivers are strewn with large boulders, and, in log-driving seasons, it becomes necessary to flood these boulders so that the logs may float over them. To flood these river bottoms often entails great loss of water, which might otherwise be stored and made available for use for power and other purposes during the low-water seasons. In some instances it may be possible for logging, water-power and other interests to co-operate in sharing the expenses incident to the improvement of those portions of the river beds which detrimentally affect log driving.

Inland Waters Attract Tourists

The value of the inland waters of British Columbia as an attraction for tourists is well known. Care should be exercised to conserve their scenic and sporting attractions. If water is to be stored in lakes and rivers for the purpose of augmenting the water supply for power, log driving, or other purposes, the possible future effect upon the tourist traffic should be ascertained. For example, if the surface of a lake is to be held for extended periods at, say, five to ten feet above its accustomed level, the water will destroy the shore-line vegetation, including such standing timber as is submerged at the higher stages. Pleasure seekers are not attracted by a lake or river fringed with five or ten feet of dead and whitened trees and shrubbery. In some instances, governments have intervened to prevent private interests from so raising the levels of certain lakes as to impair their scenic beauty.

Wherever possible, the designers of power plants should strive to have their structures harmonize with the natural surroundings. The Queen Victoria Niagara Falls Park Commissioners, for example, demanded that the power plants constructed at Niagara Falls should be of approved design and

harmonize with the scenic grandeur of the Park. Great care was exercised to ensure that works erected did not prove an offence to natural beauty and æsthetic taste. Again, anyone familiar with the great natural beauty and very attractive design of the irrigation and power plant at the Roosevelt dam in Salt river, Arizona, cannot fail to be impressed with the attractiveness to tourists of such an installation.

Not only should the design of structures harmonize with the natural beauty of their surroundings, but, after plants are erected, care should be exercised to ensure that worthy efforts in design are not nullified by failure to 'clean up.' At small expense, discarded equipment, unsightly dumps of rock and timber refuse may be cleared away, dead or unsightly trees removed, roads and trails cleared up, a few trees planted to hide the unsightly dump heaps—in fact, the whole development, with but little effort, may be made to harmonize with the landscape, rather than constitute an eyesore.

International Boundary Waters

As British Columbia has a number of streams which cross the boundary, questions may arise in connection with the utilization of these waters, which require consideration by the International Joint Commission.

Under the Boundary Waters' Treaty of 1910,* between Great Britain and the United States, provision is made that waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other. The treaty contains provisions governing the erection of obstructions for the making of diversions, whether temporary or permanent, of boundary waters, on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line ; and it also provides that where there has been any interference with or diversion from their natural channel of waters on either side of the boundary resulting in any injury on the other side of the boundary, the injured parties shall have the same rights and be entitled to the same legal remedies as if such injury took place in the country where such diversion or interference occurs. Thus, by way of illustration, the Courts of British Columbia are open to the citizens of the State of Washington, and *vice versa.*

Some of the streams which cross the international boundary require careful consideration in their possible economic relations. On the United States side there are some power-sites which, if fully developed, might have important economic bearing upon possible developments in British Columbia, either by attracting industries or competitively affecting rates. For example, there is the possible development at Kettle falls, on the Columbia river, and also on the same river the proposed development at the Dalles. At the latter site it has been estimated that a minimum of 300,000 24-hour horse-power, at

*The Rules of Procedure before the International Joint Commission will be found in *Rules of Procedure of the International Joint Commission*, and may be obtained from the Secretary, Ottawa, Canada, and also Washington, D.C.

The Boundary Waters Treaty will be found as Appendix No. 1, in *Water-Powers of Canada*, Commission of Conservation, Ottawa, 1911.

a cost of $6.89 per horse-power per year, may be produced.* Again, there is the permit† granted, in 1913, by the United States Government, involving the development of power on the Pend d'Oreille river (or Clark fork), in Tps. 39 and 40 north, range 43 east. It calls for an installation within three years from 1913 of 50,000 horse-power. This power-site, for the purposes of the permit, is deemed to be 112,000 horse-power. Again, power, irrigation and other problems may arise in connection with such rivers as the Kootenay, Okanagan, Kettle, Similkameen, or Skagit.

British Columbia is especially interested in the power and other potentialities of its boundary waters with respect to treaty obligations as well as to economic and other factors. Investigation of these waters is not being overlooked, and the Provincial Comptroller of Water Rights has been gathering hydrometric and other physical data.

Résumé and Summary

In concluding this introductory survey it will be profitable, briefly, to summarize some of the salient features touched upon in the foregoing.

First, we have observed that precipitation is the prime source of inland water supply, and that not only water-power, but such other interests as domestic and municipal water supply, agriculture, irrigation, navigation, fisheries, mining and riparian rights, are all dependent upon the same source. Consequently, water should not be allotted for power development without due recognition to the just demands of other interests having claims upon our inland waters viewed broadly as a natural resource.

Second, run-off, manifested in the form of stream flow, is intimately associated with the character of the ground upon which precipitation falls, and consequently, care should be taken to conserve vegetal cover; more especially is this necessary for rocky areas which have but scanty soil covering.

Third, sub-soil waters are by no means inexhaustible. Plant growth is dependent upon having available an adequate amount of soil moisture. Nothing should be done to deplete, unduly, the ground-water storage. Effective legislation and administration should be provided governing the tapping of underground water supplies.

Fourth, the use of water for irrigation tends materially to increase the permanent settlement of the country. Consequently, in most instances, when irrigation requirements and power requirements conflict, the former are entitled to precedence. Hydro-electric power developed on somewhat distant streams

*Respecting proposed developments on the Columbia river, consult *The Columbia River Power Project near the Dalles, Oregon*, by John H. Lewis, State Engineer, with detailed technical report by L. F. Harza and V. H. Reineking, Bulletin No. 3, Office of the State Engineer, Salem, Oregon, 1912; also *Oregon's Opportunity in National Preparedness*, Bulletin No. 5, Office of the State Engineer, Salem, Oregon, 1916. This report contains summaries descriptive of possible power developments on the Columbia river. See especially pp. 37 *et seq.*

†Respecting the proposed power development on the Pend d'Oreille, see *Permit* granting the International Power & Manufacturing Co., of Spokane, Washington, the right to construct a dam across Clark fork, or Pend d'Oreille river, for the development of power, being U.S. Senate Document No. 147, 63rd Cong. 1st Sess., Washington, 1913; also consult, *Water Rights and Power Sites in Idaho*, being letter from the Secretary of the Interior transmitting information relative to Water Rights, Power Sites, etc., acquired on the public lands in Idaho, being U.S. Senate Document No. 370, 61st Cong., 2nd. Sess.

may, by means of high tension transmission, be used for pumping water supplies where such are not available by gravity, and may thus facilitate irrigation development.

FIFTH, not infrequently navigation interests are regarded as of much greater importance than power development. Any works contemplated for the improvement of navigation should be considered in their relationship to river systems as a whole. Expenditures should be carefully watched and precautions taken to ensure that improvements, so called, are not undertaken ostensibly for navigation, when in reality they are sought for the sake of such water-power benefits as may incidentally be developed thereby.

SIXTH, the fishing industry in British Columbia is one which demands that the best possible methods be used for its conservation. Provision requires to be made for the upward migration of adult salmon for spawning purposes, and the downward passage of the young fish to the sea. Obstructions, such as dams, rock slides, log jams, etc., may have a disastrous effect upon this industry. Fishways should be provided. The whole question of fishways requires thorough investigation. Other fish besides salmon require conservation. It is not established that satisfactory means have been devised by which fish may successfully ascend over high dams—even over dams which do not exceed twenty to thirty feet in height.*

SEVENTH, the development of the mining industry during recent years has resulted largely through electrical energy being available through the development of provincial water-powers, and the future offers bright prospects for the further application of hydro-electric power to the various branches of this industry.

EIGHTH, the pollution of inland waters must be most jealously guarded against. Mining, factory and industrial wastes and sewage must not be permitted to foul inland waters. Debris and other waste resulting from logging operations are apt to cause serious log jams, which are a menace to public highways, bridges and also to power development.

NINTH, the tourist traffic is a valuable provincial asset, not only because of the money actually spent by travellers, but because of the opportunity afforded of drawing attention to the various natural resources of the province. Consequently, every reasonable care should be taken to guard against the spoiling of shorelands through submergence: and further, care should be exercised in the design and construction of power works, making them, where possible, harmonize with the general natural features of their surroundings.

TENTH, in connection with the use of boundary waters, problems, from time to time, may arise necessitating consideration by the International Joint Commission. In this connection, therefore, it is especially desirable that physical data appertaining to such waters should be so collected as to be available for use in connection with such problems as may arise respecting waters which are classed in the Boundary Waters Treaty as 'boundary waters.'

*Not discussed in detail in this chapter as subject is covered in *Fishways in the Inland Waters of British Columbia.*, by Arthur V. White, published by Commission of Conservation, Ottawa, 1918.

CHAPTER II

Water-power Data

IN this chapter it is proposed to set forth, briefly, some broad guiding principles which should be fully comprehended by those who have occasion to consider the factors basic to estimates respecting the physical magnitude and economic importance of water-power projects.

The United States has devoted much attention to the acquiring of information respecting i[illegible]nd water resources, and, since 1895, has been conducting a systema[illegible]tion to determine its water resources. This work has involved th[illegible] of surveys, the gauging of streams, the investigation of underground waters and artesian supply, the preparation of reports upon the best methods of utilizing and conserving the water resources, as well as research along many other lines. During 1895 to 1915, inclusive, the United States appropriated nearly $2,500,000 for this work, and, in addition, individual states expended large sums for similar investigations. In Canada, especially since 1910, great advances in the gathering of stream flow and other hydrometric data have also been made by both federal and provincial authorities, and large sums of money have been appropriated for such work.

One of the chief objects in securing and publishing data respecting water-powers is to enable the owners of rights to determine the possibilities and limitations of their powers, and thus arrive at sound judgment respecting their possible uses and value. Another object is to enable prospective promoters to learn the general possibilities of various powers, without the necessity of making costly independent preliminary surveys. Certainly if the Crown be the owner of water-powers, it is of the utmost importance that it be informed beforehand upon essential facts connected with its water resources.

Broad Classification of Water-powers

Although the amount of water-power is essentially determined by two basic factors ; one, the hydrostatic head, or the vertical distance through which the water may fall ; the other, the amount of water which may be made to operate upon the water-wheels, yet there are many characteristic features associated with water-powers which differentiate one power from another and which, respectively, determine their commercial and economic values. These features should be well understood.

Water-powers, from one viewpoint, may be considered on the basis of their probable uses. Those capable of being employed for supplying electrical energy for municipal and community purposes, such as lighting, heating, pumping, and certain kinds of manufacturing, should be regarded as having greater economic value than those situated where power is only usable in large manufacturing plants, the supplying of the raw material for which virtually

means the destruction of Nature's balance in the territory where the plants operate.

Again, the uniformity of the available flow in streams varies greatly. The St. Lawrence river, owing to the vast natural storage capacity of the Great lakes, has the most uniform flow of any large river in North America, or probably in the world. The proportion of its flood to minimum flow is about 2 to 1. On the Winnipeg river, above English river, the ratio is 6 to 1; on the Ottawa river it exceeds 15 to 1; on the Columbia river, at the Dalles, Oregon, it is 28 to 1; on the Delaware river at Port Jervis, N.J., it is 375 to 1; in British Columbia, on the Pend d'Oreille river, it is 16 to 1; on the Kootenay river at Bonnington falls, it is 25 to 1; on the Fraser river at Lytton, it is 38 to 1; on the Campbell river, Vancouver island, it is 43 to 1. On smaller watersheds the ratio is usually greater and on some streams draining even areas of considerable size the minimum flow is zero.* Other conditions being equal, water-power developments on a river like the St. Lawrence would be of very much greater value than developments on a river subject to such great variations of flow as, for example, the Mississippi.

Another feature is the possibility of being able to make a partial development of a power-site, or portion of a stream, more cheaply than the same sized development could be made if constructed as part of a comprehensive scheme designed eventually to utilize all the available power. Thus, not infrequently a partial development unwisely planned, has precluded subsequent full development, save at almost prohibitive cost. For example, suppose a certain power-site is capable of yielding 10,000 h.p. If development rights are let to A for 2,000 h.p., to B for 1,000 h.p. and to C for 1,000 h.p., and A, B, and C are allowed to design and construct their individual works irrespective of each other, or of the possible development of the remaining 6,000 h.p., then, it will probably become quite impracticable to get anything like the remaining 6,000 h.p., because of the damage that would be caused to the plants of A, B and C. On the other hand, if preliminary works are constructed with a view to utilizing, as occasion demands, any amount of power up to the full 10,000 h.p., no such contingency as has been supposed could well arise. Consequently, regulations respecting power-sites should be so framed as to require that preliminary installation of dams and other main works necessary for the control of the waters he made having regard to the possible future development of the full water-power that may be made available.

It is as unreasonable not to differentiate between water-powers as it would be not to differentiate between timber tracts, mineral lands, fisheries, or any other natural resource varying in quantity, quality and situation.

It should not be forgotten, when making representations respecting the amount of power that may be available for any particular site, that it is necessary to know the conditions of the river at which the stated amount of power may be produced. The minimum, or *primary power*, as it is frequently termed,

* The figures for the rivers in British Columbia are based on relatively short records of from 3 to 8 years. It is interesting in this connection to note that the ratio of flood to minimum flow for the Columbia River at the Dalles for the five year period ending 1915, was 15 to 1, or little more than half the ratio given above for the long period record of 37 years.

BRITISH COLUMBIA ELECTRIC RAILWAY CO.
Coquitlam-Buntzen development   General view of Coquitlam hydraulic-fill dam with water flowing over spillway.

BRITISH COLUMBIA ELECTRIC RAILWAY CO.
Ambursen type of dam on Jordan river, Vancouver Island, with water passing over spillway.

is the amount of power that may be developed during the period of lowest flow. It has been defined as the amount of power which is available for every hour of every day of every year. What is frequently termed *secondary power* is usually many times the primary power. As very low-water conditions generally last for but a comparatively short portion of the year, it is usually possible to develop during the greater portion of the year a considerably larger amount than the primary power. Frequently, this larger amount can be effectively utilized for industries not requiring continuous plant operation.

The pre-determination of the probable amount of power which any particular water-power site may be made to yield, is a problem that calls for more extensive hydrometric data than is furnished by scattered and non-consecutive measurements of stream flow, precipitation, etc. Also, it is very important that such cognate data be available as will enable a sound opinion to be formed respecting the relationship which any proposed power development may bear to any other water interest or interests that may be involved. If some important relationship is overlooked, sooner or later its importance will demand recognition by those who proceeded in defiance of its just claims.

In estimating the amount of power that may be developed, hydrometric records of precipitation, temperature, run-off, etc., extending, if possible, over a period of fifteen, or more, years should be available satisfactorily to appraise the probable regimen of the waters involved.

Financial Interests Should Exercise Caution Twenty years or so ago, when water-powers began to be developed much more extensively owing to the advancement in the art of electrical transmission, there was not available anything like the body of stream flow and other hydrometric data that exists to-day. There was then more excuse than now for errors in engineering and other estimates respecting the performance of water-power installations. Many large plants have proved financial failures on account of such errors. With all the data now available relating to hydrological conditions, cost of construction, market possibilities, etc., it is clearly incumbent upon those interested from the financial side of proposed developments, to exercise the same kind of common judgment they would display in collecting and appraising facts relating to any other set of circumstances. A financial agent could readily look over past statements of a concern and learn its lowest or highest yearly or monthly revenues, profits, etc. If he should find periods when the profits dropped to, say, 2 per cent, he need never be misled by the assurances of some enthusiastic promoter that profits in the concern "might be 20 per cent and had never fallen below 5 per cent." Similarly, anyone interested in possible power development may now readily place himself in possession of data which will, at least, give some independent check upon representations that may be made respecting the physical magnitude and approximate cost of development of water-power in which he may be interested.

Thus, by way of simple illustration; if a low flow of a stream has been recorded, this quantity in cubic feet per second multiplied by the total available head in feet and then divided by 11, gives the low-water horse-power of the stream on the basis of 80 per cent efficiency. Such a figure, then, consti-

tutes a check upon any representations. Similarly, in connection with storage benefits, no reliance should be placed upon vague statements to the effect that 'ample storage is available.' The flow corresponding to certain effective water storage may readily be checked. A depth of one foot on an area of one square mile is equivalent to a continuous flow of approximately 0.88 cubic feet per second for one year. Thus, a depth of 10 feet of effective storage on a lake 10 square miles in area would maintain a continuous flow of 88 second-feet for a year, or 176 second-feet for 6 months, or 352 second-feet for 3 months. The extent to which such storage could be employed to equalize flow would, of course, depend upon how it could be co-ordinated to the run-off as distributed over any selected period.

Topographic Maps Necessary

In addition to such hydrometric data as have just been indicated, a knowledge is required of the topography and other physical characteristics of watersheds. The basis for considering this class of information is a reliable map, giving the results of an adequate topographic survey and showing the contours of the country. It is, therefore, important that maps be available showing the areas of the drainage basins, the locations of possible reservoir sites, and their situations with respect to public necessities, irrigable lands, water-powers and navigation resources.

The maps of the lesser known portions of Canada have been constructed largely from data collected by survey and exploration parties, carrying on reconnaissance surveys to determine the general geological structure, the outstanding topographic features and the extent and general character of the forest, agricultural, arid, swamp and other sections of the country. Since the lakes, rivers and streams usually constitute the natural highways of explorers, they have frequently indicated on their maps such obstructions to navigation as falls and rapids. While the limitations of the information regarding the water-powers incidentally collected and published in reports are recognized, it has, nevertheless, been deemed profitable to refer to the principal statements found in such reports. Throughout our investigation the descriptions of topography given in the reports of the Geological Survey of Canada have been of very great value, and have been freely used. In connection with exploratory work, where it can consistently be done, it should be part of the standing instructions to all surveyors and explorers in the employ of governments in Canada, to embody in their reports the most accurate information procurable respecting water supply, water-powers and reservoir sites in the territory traversed.*

Caution Necessary Respecting Information

Great caution must be displayed respecting the uses made of information in reports, the character of which is not fully defined. Little confidence can be placed in any reports of water-powers not based upon actual measurements, for, without proper measurements, the best judgment of explorers, and even of engineers, as to the heights

*Consult, *Instructions Relating to the Gathering of Certain Preliminary Information Respecting Water-Powers*, by Arthur V. White, Pamphlet, Commission of Conservation, Ottawa, 1912.

of falls, and the amounts of water discharging over them, is frequently very wide of the results disclosed by actual measurements.

This is well illustrated by an experience related by an engineer of the Ontario Hydro-Electric Power Commission. Prospectors told him that the falls on the Kawashkagama river were capable of developing 30,000 h.p. *at low water* ; and a surveyor assured him that the Kawashkagama could yield as much power as the Kaministikwia. After a hard journey, the engineer arrived at the falls, and found 317 h.p. instead of the 30,000 h.p. reported.

An interesting illustration of how one might be misled by casual statements relating to water-powers published in reports, is found in one of the annual reports of the Minister of Lands for British Columbia, where two references are made to Long river, tributary to McLeod lake. In a report on exploratory surveys in the Peace, Parsnip and Finlay River valleys, incorporated therein, it is stated :

"About fifteen miles farther the trail reaches Carp lake, a considerable body of water, with numerous islands. From this lake Long river, *a large stream*, runs through Long lake to McLeod lake. This river carries nearly half of the water which leaves McLeod lake as the Pack river. About a mile below the outlet from Long lake there is a series of falls on Long river, from which *an enormous amount of power* could be obtained."*

The second reference occurs in a report from another surveyor dealing more particularly with exploratory surveys of a route from Bellakula to McLeod lake. This surveyor states :

"Carp lake flows into Long lake, a small sheet of water some two miles in length, with banks rising steeply to about 100 feet to join the plateau-level. Out of Long lake flows Long Lake river, *a small stream* some 60 feet wide and 18 inches deep. About a quarter of a mile below the outlet of the lake the stream becomes swift, and just beyond is a series of rapids and falls, the water descending in three long leaps of about 40 feet each. *There is not sufficient water to use this for power purposes*, but it could be used to advantage in irrigating the level jack-pine terraces, which descend gradually from here to McLeod lake."†

Thus, when referring to the same stream, one explorer characterizes it as "a large stream," with "an enormous amount of power," while the other explorer states that it is "a small stream" and that "there is not sufficient water to use this for power purposes."

There is no excuse for persons making serious mistakes through giving to such information a credence not warranted by its general character. Serious financial losses in power developments usually result from failure correctly to interpret the significance of data of a more or less precise character and which may be available ; or from leaving out of consideration factors, the necessity for weighing which would have been foreseen by those of sufficient experience.

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* *Report of Minister of Lands*, British Columbia, 1912, p. D325.
† Ibid, p. D347.

Serious Failures of some Developments

In the ten or twelve years preceding 1915, eighteen large hydro-electric plants in the United States, totalling over 600,000 developed horse-power, and involving investment in the vicinity of $125,000,000, proved financially unprofitable. These are as follows :*

PARTIAL LIST OF MORE RECENT WATER-POWER DEVELOPMENTS IN THE UNITED STATES WHICH HAVE EITHER BEEN THROUGH RECEIVERSHIPS OR PROVED BAD INVESTMENTS

Plant	Horse-power
Hudson River, Spice Falls, N.Y., Mechanicsville, N.Y.	52,000
Michigan Lake Superior Power Co., Sault Ste. Marie, Mich	23,000
Great Shoshone & Twin Falls Water Power Co., Pocatello, Idaho	10,000
Animas Power & Lighting Co., Durango, Colo	4,500
Central Colorado Power Co., Denver, Colo.	40,000
Wisconsin Railway, Lighting & Power Co., Hatfield, Wis	8,000
McCall Ferry Power Co., McCall Ferry, Pa.	80,000
Hanford Irrigation & Power Co., Priest Rapids, Wash	4,000
Yadkin River Power Co., Rockingham, N.C.	25,000
Hauser Lake (Mont.) Power Co.	15,000
Chattanooga & Tennessee River Power Co., Chattanooga, Tenn	40,000
St. Lawrence River Power Co., Massena, N.Y.	60,000
Austin Dam, Tex.	25,000
Stanislaus Electric Power Co., San Francisco	50,000
Whitney plant, on Yadkin River	20,000
Miscellaneous small water powers	50,000
Alabama Power Co.	70,000
Appalachian Power Co.	40,000
Total	616,500

It is claimed that much of the failure in connection with such projects, has resulted from the mistakes of engineers. These have been described as "honest mistakes in most of the cases" and were due to mis-estimates of the quantity of water available, running all the way from 30 to 100 per cent. There were, also, other serious mis-estimates respecting the cost of the enterprises which resulted, not infrequently, in the projects costing nearly double the estimates.

Financial interests contemplating investment in water-power development cannot afford to proceed without reckoning with power from coal.†

*For statements here made consult, 'Testimony of Mr. H. L. Cooper before the United States Senate Committee on Public Lands' in *Hearings re An Act to Provide for the Development of Water Power and the Use of Public Lands in Relation Thereto, and for Other Purposes*, pp. 292 *et seq.*, Washington, D.C., 1915.

Many such plants are eventually placed upon a better financial basis for those who acquire them under 'reorganization.' The initial losses, however, remain.

† During recent years, in the art of developing power from steam, great improvements have been made in many mechanical devices designed to economize in labour, fuel, steam, lubrication, etc. The net advantage of these savings however is, to some extent, being offset by the steady rise in the cost of coal. This rise in cost and the possibility of interruption of supply, requires special consideration by those in Canada who are dependent upon coal supplied from the United States. In this connection consult : Articles by Arthur V. White in *University Magazine* re "Exportation of Electricity," October 1910, p.p 460 *et seq.*; and "Exportation of Electricity—Relation of a Possible Coal Embargo by United States to a Curtailment or Stoppage of Canada's Electric Power," in *Monetary Times*, January 5th., 1917, pp. 21. *et seq.*; see also *Sixth Annual Report of the Commission of Conservation*, Ottawa, 1915, pp. 136-151 ; also *Seventh Annual Report*, 1916, pp. 176-184, also *Eighth Annual Report*, 1917, pp. 227-242 ; and

Such reckoning must be made chiefly from two standpoints ; one regarding steam power as a straight competitor ; the other considering steam power to be used as an auxiliary source to augment the supply of hydraulic power during periods of low water. During recent years great advances have been made in the art of developing power from coal and the cost of power from this source has been very materially cheapened. These subjects, however, do not fall within the scope of the present report, but attention is drawn to them, because, in the future, the co-ordination of steam power to hydraulic power will have to be given much greater economic weight than in the past.

In a word, too much emphasis cannot be placed upon the necessity for giving the fullest possible consideration to all essential factors connected with proposed water-power installations *before proceeding with actual development.*

General Statements Criticized

There are in Canada an exceptionally great number of lakes, many of large size, and it has sometimes been suggested that where there are such extensive water areas there probably is associated therewith a large amount of water-power. But water is not necessarily water-power, and comparisons of water areas in different territories, while interesting and valuable for some purposes, are apt to be misleading, especially if used—as they have been used—to suggest that the total amount of water-power is great owing to the existence of numerous and extensive water areas.

The impossibility of basing estimates upon such considerations may readily be perceived. Take, for example, the Nechako River watershed in British Columbia, with an area of some 17,900 square miles. The total known water area of the province is estimated at about 4,000 square miles. Of this, about 1,000 square miles, or 25 per cent, is in the Nechako River watershed, and, although there are several valuable water-powers in this drainage basin, yet its waters would only yield about two per cent of the estimated water-power of the province.

What is true of generalizations respecting water areas is also correspondingly true of watershed areas. The area drained by the Columbia river in the United States, is about 220,300 square miles,* or 7·3 per cent of the total area of the United States, excluding Alaska, and yet it has been estimated that the Columbia river and its tributaries afford at least one-third of the available water-power in the entire United States. Thus, over 30 per cent of the total water-power of the United States is associated with less than 7·5 per cent of the total area.

Again, it is unsafe to predicate power resources upon the total descents of rivers. This is well illustrated by a comparison between the water-power

*In addition there is an area of this watershed in Canada of 38,700 square miles.

possibilities of two of the larger streams of Vancouver island, Campbell river and Nimpkish river. These rivers drain adjacent territories of approximately equal areas and with total descents in the main portions of the river of similar amounts. The power possibilities of the Campbell river, however, with its concentrated possible developments, may be estimated at about 100,000 horse-power as contrasted with some 15,000 horse-power for the Nimpkish.

Therefore, neither water area, nor watershed area, nor average differences of elevation over considerable distances have, necessarily, any specially significant bearing upon estimates of the amount of available water-power, and, hence, general statements based upon such considerations must be regarded as but indefinite generalities.

One of the chief dangers in giving undue significance to such generalities, is to create or foster in the public, and especially in the popular mind, a feeling of unwarranted assurance that even though desirable water-power rights are being granted by a government, yet there is so much left that no apprehension need be entertained respecting the amount of power rights being parted with. One is apt to forget that the dissemination of such generalities is too often part of a plan to make easy the acquisition, by interested parties, of the most coveted privileges.

For years it was the practice of various interests to issue, through the daily press and otherwise, for public consumption, statements drawing attention to enormous amounts of 'potential' water-power. Estimates in the United States have ranged all the way from 20,000,000 to 200,000,000 horse-power, the larger figures being based upon theoretical estimates of utilizeable storage. No data existed in Canada warranting anything more than a very rough estimate, leaving storage out of consideration.

Concentration of Control of Water-power

While such generalities were being disseminated, large power interests were acquiring the rights for the more desirable properties. A survey, in both Canada and the United States, of power sites most suitable for economic development, shows that most of the best sites either have already been developed or are held by various interests for future development. Concentration of control, however, has been much more extensive in the United States than in Canada. Some idea of the extent to which concentration of ownership and control by interests has proceeded in the United States, is found in the fact that, in 1911, of the total 'commercial' water-power of 2,962,000 h.p. developed and under construction in the United States, over 1,800,000 h.p. was controlled to a greater or lesser extent by ten groups of interests. These are as follows :*

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* See Report of Herbert Knox Smith, U.S. Commissioner of Corporations, on *Water Power Development in the United States*, March 14, 1912, Washington, D.C., page 15 ; for significance of 'commercial,' see *ibid* page 5.

COMMERCIAL WATER-POWER CONTROLLED BY OR UNDER THE INFLUENCE OF COMPANIES OR GROUPS OF INTERESTS EACH HAVING 50,000 h.p. OR MORE ACTUALLY DEVELOPED OR UNDER CONSTRUCTION.*

Companies or groups of interests	Developed and under construction horse-power	Undeveloped horse-power	Total horse-power
General Electric interests:			
(a) Power completely controlled	82,860	5,500	88,360
(b) Power coming under General Electric influence where there occurs both minority ownership of securities and common directors	419,060	522,600	941,660
(c) Power coming under sphere of General Electric influence through common directorships only	437,195	113,500	550,695
Total, General Electric group	939,115[1]	641,600[2]	1,580,715
Stone & Webster interests	278,067	372,350	650,417
Hydraulic Power Co. of Niagara Falls	144,000	20,000	164,000
Pacific Gas & Electric Co.	118,343	100,000	218,343
Clark-Foote-Hodenpyl-Walbridge interests	104,300	158,000	262,300
Southern Power Co.	101,680	104,000	205,680
S. Morgan Smith interests	76,550	96,000	172,550
Brady interests	70,600	16,200	86,800
United Missouri River Power Co.	65,000	....	65,000
Telluride Power Co.	56,350[3]	21,300	77,650[3]
Grand Total[5]	1,821,305[4]	1,449,450[4]	3,270,755[4]

[1] Includes 84,700 h.p. also included with Stone & Webster interests and 48,000 h.p. included with Clark-Foote-Hodenpyl-Walbridge interests.

[2] Includes 5,000 h.p. also included with Stone & Webster interests and 75,000 h.p. included with Clark-Foote-Hodenpyl-Walbridge interests.

[3] Including 4,500 h.p. belonging to the Beaver River Power Co.

[4] Does not include power duplicated in General Electric, Stone & Webster, and Clark-Foote-Hodenpyl-Walbridge interests.

[5] Owing to the interlocking of interests, these totals do not, as they stand, arithmetically give the total of the separate figures in the columns.

This concentration has been proceeding wherever possible. On December 16, 1914, at the hearings at Washington on the proposed new Water-power Bill, designed to provide for the Federal administration of the water-powers of the United States, Mr. Gifford Pinchot, when appearing before the Committee dealing with the bill, made the striking statement that: "during the last two years the large group of water-power interests increased their control of undeveloped water-power in the United States by 2,050,000 horse-power." He further stated that:

"In 1911, the ten greatest groups had, developed and under construction, 1,821,000 h.p.; and in 1913 they had 2,711,000—an increase of 890,000 h.p. In 1911, the ten greatest interests held undeveloped 1,450,000 h.p., which had risen to 3,500,000 in 1913—an increase of 2,050,000 h.p. in two years.

"These figures show that, in the last two years, the great power interests have increased their control of power held undeveloped more than twice as fast as they have increased their control of developed power.

*The degree of control varies greatly, as set forth by the Commissioners' report.

"The same preference of the water-power interests for concentrated control, rather than for development, may be shown in another way.

"In 1908, the total developed water-power in the United States was, in round numbers, 5,400,000 h.p., and in 1913, it was 7,000,000, an increase of about 33 per cent for the five-year period. In 1908, the thirteen greatest groups of interests controlled a total of 1,800,000 h.p. developed and undeveloped, while, in 1913, a smaller number—ten—of the greatest groups controlled a total of 6,300,000 h.p. developed and undeveloped, an increase of 240 per cent. Thus, concentration in ownership of water-power in the United States has increased in the last five years about seven times faster than power development.

"These figures show that, instead of spending their money to develop the power sites they had, the great water-power interests have been spending the money to acquire and to hold power sites undeveloped, to meet not a present, but a future demand. The concentrated control of the undeveloped power sites of the country appears to have been their object. The very men whose control of undeveloped water-power increased by 2,050,000 h.p. in two years are now complaining without a shred of justification, except what they themselves produced, against the hampering of water-power development."*

The United States Commissioner of Corporations, as a result of his investigation into the water-power situation in the United States, drew special attention to the maze of inter-relationships ranging from practically joint control down to personal association in common directorates, as clearly indicating a drift on the part of water-power and public utility corporations to pass under the control of a few very powerful interests. The Commissioner reported :

"These connections, some stronger and some weaker, suggest a favourable condition for a very small number of men to consolidate very large interests whenever they may decide it to their advantage to do so. This interlocking of interests through directors, while not necessarily indicating a purpose of monopoly, certainly affords an incentive and a means of combination."

Legislation, both federal and provincial, makes it difficult to effect such extensive concentrations in Canada, but, nevertheless, the corresponding menace exists also in this country, and calls for constant watchfulness and action against its aggressiveness.

Storage and Governing Factors

Although the presence of numerous lakes does not necessarily imply the existence of considerable water-power, there is, nevertheless, one very valuable feature likely to be associated with extensive water areas, namely, the existence of natural reservoirs where waters may be impounded for discharge under control. Obviously, water-powers directly benefited by such storage reservoirs may be of much greater value than other powers not so favoured. This should be taken into special consideration when water-powers are being classified according to their economic values.

In British Columbia there are a large number of lakes. Of the known lakes, 100 are above 10 square miles in area. Many of these lie in long, narrow valleys, and may rather be regarded as river expansions, as, for example, the Arrow lakes, where, at high-water, there is a perceptible current in the shallow-

*See *Hearing re* Water-Power Bill, pp. 232-3. See note *supra*.

est parts. A large proportion of the lake area is situated in what has been termed the Lake district, which, with the exception of Babine lake and some lakes at the head-waters of the Morice river, is nearly all tributary to the Nechako river.

Although there are but few large lakes along the coast, yet a number of good reservoir sites are known and many others may yet be found. In some of the dryer areas of the province, reservoirs have been created to impound the whole winter run-off and spring flood flow for the use of irrigation, but, not infrequently, difficulty is experienced in procuring sufficient water. On the coast, however, corresponding difficulty in replenishing the draft upon storage would not be experienced, because, in addition to the heavy flow in spring and summer, similar to that experienced in the interior, due to the melting of snowfields and glaciers, there is a large flow in the autumn and winter seasons resulting from heavier precipitation, especially noticeable at the time of the autumn rains. It may be emphasized that the physical possibilities for creating storage in British Columbia, are undoubtedly greater than will be disclosed, except by special and careful investigation. Along the coast especially, the nature of the rock and the formation of many of the valleys lend themselves to the construction of satisfactory reservoirs by the erection of high dams below small lakes or extensive stretches of low grade valleys.*

When the subject of storage reservoirs is under consideration it should not be forgotten that Nature also stores her waters otherwise than in lakes and rivers. Forest floors, extensive areas covered with plant growth and the great swamps of the country, also glaciers and snowfields, each and all constitute valuable water reservoirs. In such reservoirs there is a widespread and satisfactory distribution of waters which enables Nature to yield her supplies gradually and as required. A discreet conservation and utilization of such reservoirs will generally be found much more desirable than are some of the artificially constructed reservoirs, where the liability to accidental destruction of dams or other works is always more or less of a menace.

When utilizing a lake for storage, if the stages which would prevail in a state of nature are to be changed, and if the lake is to be maintained for extended periods at substantially higher stages, it should be borne in mind that it is impossible, with discharge channels as in a state of nature, thus to regulate the level of a lake without infringing the rights of riparian owners. For example, if a lake is, so far as possible, maintained at, say, the mean or average stage existent in a state of nature, and high flood discharge is to be stored in the lake, a time will inevitably come when the lake will rise higher than the extreme high-water mark in a state of nature. Again, if the stage of a lake is raised, say, to its mean water level in a state of nature, and, by having avail-

*The United States Department of Agriculture, Office of Experiment Stations, has issued two valuable publications by Samuel Fortier and F. L. Bixby, relating to the storage of water for irrigation purposes, in which will be found descriptions and illustrations, showing methods of construction, etc., of various types of dams. The publications are: *Earth-fill Dams and Hydraulic-fill Dams*, Washington, D.C., 1912; also *Timber Dams and Rock-fill Dams*, Washington, D.C., 1912;—being Parts I and II of *Bulletin, No. 249.*

able enlarged outlets, is controlled at such stage, then the surplus waters discharged must, at times, cause the extreme high-water stage in a state of nature to be exceeded in the water courses into which the lake discharges. Without increased capacity of outflow channels, any control of outflow, whatsoever, must inevitably result in creating higher levels than the highest which would have occurred in a state of nature during the given period. In a word, attempts to substantially alter the regimen of waters from their natural conditions, may result in a serious invasion of riparian rights around storage lakes or the water courses below same, or both.*

In anticipation of the probable need for providing storage in lakes or for the raising of the high-water stages of lakes or rivers, it is very desirable that governments, when granting riparian rights on the shores of lakes and rivers, should reserve an easement for flowage, extending, say, to a contour at an elevation at least five or ten feet above extreme high-water mark. High-water years usually recur in cycles, and, not infrequently, certain cycles recur in periods of fifteen to twenty or twenty-five years. Settlers may come into a country and take up land along the shores of inland waters, and frequently, through inability to interpret the physical indications along the shores indicating former stages of high-water, construct buildings and make improvements upon low-lying areas which are sure to suffer damage upon the recurrence of the next extreme high-water conditions. This is the common experience. In 1904, the water reached a stage on Kootenay lake several feet above the tops of the railway trains as they now stand at the station. What will be the effect of the recurrence of such flood conditions ? Extreme flood conditions doubtless will again recur in British Columbia, and those who have settled in the lower portions of valleys, or on bench lands that have been flooded in earlier years, must expect to suffer serious loss. When times of extreme flood conditions do arrive the amount of water retained by such reservoirs as are available in British Columbia, will be relatively insignificant. The protection against damage must be made by refraining from making perishable improvements, such as erecting buildings on lands that are apt to be overflowed, and this is especially true for those lands where physical evidences of former high-water stages have been recorded on the shores. With respect to flood conditions it may aptly be said, "The thing that hath been, it is that which shall be . . . and there is no new thing under the sun."

Lakes of British Columbia

The following table gives a list of the larger lakes in British Columbia. Many of the lakes have not been instrumentally surveyed, but have been drawn on maps from sketches and other information furnished by those who have visited them. There is con-

*Discussion upon this subject, along with reference to other results consequent upon the creation of artificial storage, will be found in the report to be issued by the Consulting Engineers to the International Joint Commission relating to an investigation which involves the storage and regulation of the waters of the Lake of the Woods watershed. In that investigation such interests as those of navigation, riparian owners, water-powers, fishing, logging and summer tourists, desired different levels for the lake. It was impossible to decide upon specific levels or ranges of levels which would be equally satisfactory to all parties concerned. It was therefore necessary to weigh the advantages and disadvantages for the several interests and endeavour to reach a compromise reasonably satisfactory to all concerned. See footnote page 7.

siderable difference between the configuration of lake area as shown on maps of different periods. These differences in many cases amount to a large percentage of the area, and result in corresponding differences in estimates presented in various reports.

The areas of the lakes have been measured chiefly from maps of Cariboo and adjacent districts, being Map No. 1G, scale 7.89 miles = one inch, 1916; Kootenay, Osoyoos and Similkameen districts, being Map No. 1E, scale 7.89 miles = 1 inch, 1915; Southerly portion of Vancouver Island, being Map. No. 46, scale four miles = one inch, 1913; the map of British Columbia (in four sections), scale 17.75 miles = one inch, 1912, and several others.

LAKES OF BRITISH COLUMBIA OF NET AREA OF 10 SQUARE MILES OR OVER

District*	Lake	Situation of outlet				Elevation†	Length*	Width*	Area
		Lat. N.		Long. W.					
		°	′	°	′	feet	miles	miles	sq. m.
T.	Adams	50	56	119	39	1,357*a*	39	2¼	54
F.	Alexander (tr. Stuart)	55	02	125	00		7	2	11
F.	Anderson	50	32	122	19	846	13	1½	10
Y.	Atlin	59	37	133	43	2,200	65*b*	8*b*	40*b*
T.	Azure (tr. Clearwater)	52	26	120	12	2,500	15	1½	11
P.C.	Babine (tr. Skeena)	55	21	126	41	2,222	100*c*	7	260*c*
T.	Bonaparte	51	17	120	40	3,834	11	1½	13
V.I.	Buttle	49	48	125	40	728	18	1½	11
T.	Canim (tr. Clearwater)	51	52	120	36	2,557	16	2¼	23
M.	Charlie (tr. Peace)	56	17	120	56	2,289	11	2½	15
F.	Cheslatta (tr. Nechako)	53	41	125	04	2,800	24	1	15
F.	Chilko	51	39	124	06	3,880	48	4	97
C.	Christina (tr. Kettle)	49	02	118	13	1,531	11	1¼	10
M.	Chuchi (tr. Parsnip)	55	11	124	23	2,413	18	1½	17
T.	Clearwater	52	13	120	08	2,480	14	1¾	16
F.	Cluculz (tr. Nechako)	53	54	123	35	2,500	10	2	13
C.	Columbia	50	18	115	51	2,652	10	1½	11
V.I.	Cowichan	48	50	124	03	533	20	2	24
F.	Cunningham (tr. Stuart)	54	34	125	09		12	1½	12
M.	Dease (tr. Liard)	58	49	130	07	2,660	25	2	25
K.	Duncan (tr. Kootenay)	50	17	116	57	1,835	10	1½	10
P.C.	Eahlueh (tr. Iskut)	57	42	129	46		25	2	40
F.	Emerald (tr. Nechako)	53	43	127	01	2,725	21	2	38

* The letters in the first column indicate to which main watershed or district each lake belongs as follows: C.—Columbia River watershed (except Kootenay river); K.—Kootenay River watershed; F.—Fraser River watershed (except Thompson river); T.—Thompson River watershed; V.I.—Vancouver Island; P.C.—Mainland Pacific Coast district; M.—Mackenzie River watershed; Y.—Yukon River watershed. The second column gives, in addition to the names of the lakes, the names of the larger streams to which the lakes are tributary. The situation of the outlet is given by latitude and longitude. The elevations have been taken from various sources, chiefly from the *Dictionary of Altitudes of Canada*, and from certain maps. The length given usually is the maximum along the centre of the lake. The width is the average width of the widest part; in some instances, notably Harrison, Powell and Atlin lakes, the centre of the widest part of the lake is occupied by a large island; in these few cases, the width given is that of the widest part of the water surface.

† When elevations of high and low water are available, the low water elevation only is given. For other levels consult *Altitudes in Canada*, also latest maps.

a. Controlled by lumber dam at outlet.

b. Includes about 1 m. of length and 2 sq. m. of area in Yukon, large island at widest part, maximum width of lake 12 m.

c. Longest and largest lake in British Columbia; tributary watershed not extensive.

District	Lake	Situation of outlet Lat. N. ° ′	Long. W. ° ′	Elevation feet	Length miles	Width miles	Area sq. m.
F.	Euchu (tr. Nechako)	53 25	125 14	2,654	14	1¼	13
F.	Eutsuk (tr. Nechako)	53 20	126 07	2,790	45	5 *d*	180
F.	Francois (tr. Nechako)	54 01	125 00	2,375	60	2½	100
F.	Fraser (tr. Nechako)	54 05	124 36	2,192	12	2	20
Y.	Gladys (tr. Teslin)	59 54	132 53	2,915	20	2	30
F.	Great Beaver (tr. Salmon)	54 28	123 42		18	1¼	14
V.I.	Great Central	49 20	125 01	260	22	1½	20
T.	Green (tr. Bonaparte)	51 36	121 05	3,428	11	1¼	12
F.	Harrison	49 18	121 48	28	36	3½*e*	84
T.	Hobson (Upper Clearwater)	52 29	120 16		19	1	15
F.	Horsefly (tr. Quesnel)	52 22	121 18		26	1½	21
F.	Inzana (tr. Stuart)	54 59	124 47	2,260	16	1½	15
F.	Isaac (tr. Quesnel)	53 08	120 55	3,180	19	1½	24
P.C.	Iskut	(See Kinaskan)					
T.	Kamloops	50 45	120 53	1,009	18	1¾	44
V.I.	Kennedy	49 06	125 36		12*f*	2½	24
P.C.	Kinaskan (tr. Iskut)	57 35	130 12	2,800	11	2	15
P.C.	Kitlope (Gardner canal)	53 20	127 27	30	8	2	12
K.	Kootenay	49 29	117 29	1,749	66*g*	3	170
M.	Kotcho (tr. Hay)	59 01	121 07		15	7	90
F.	Lillooet (tr. Harrison lake)	50 03	122 31	680	22	1¼	17
P.C.	Link (Ocean Falls)	52 22	127 48	120*h*	12	2	10
C.	Long (tr. Okanagan)	50 14	119 16	1,275	13	1¾	13
P.C.	Loring (tr. Bulkley)	54 01	127 14	2,600	27	4	65
C.	Lower Arrow	49 20	117 52	1,382	53	1¾	60
T.	Mabel (tr. Shuswap)	50 36	118 45	1,270	22	1½	24
T.	Mahood (tr. Clearwater)	51 55	120 15	2,081	11	1¾	15
P.C.	McAuley (tr. Bulkley)	53 46	127 17		16	2	30
M.	McLeod (tr. Parsnip)	54 59	123 06	2,250	13	1½	11
P.C.	Mesiadin (tr. Nass)	56 03	129 23		9	1½	10
M.	Moberly (tr. Peace)	55 52	121 37	2,050	11	2	20
T.	Murtle (tr. Clearwater)	52 05	119 49	3,650	12	2½	21
F.	Natalkuz (tr. Nechako)	53 25	125 06	2,647	13	1¾	17
V.I.	Nimpkish	50 31	127 02	35	12	1½	12
V.I.	Nitinat	48 40	124 51		13	1	10
C.	Okanagan	49 30	119 36	1,125	67	3	141
F.	Ootsa (tr. Nechako)	53 38	125 42	2,670	38	2½	56
P.C.	Owikano (Rivers Inlet)	51 41	127 14	10	30	2	37
F.	Pinchi (tr. Stuart)	54 37	124 29	2,300	14	2½	22
F.	Pitt	49 21	122 37	Tidal	17	2½	21
P.C.	Powell	49 52	124 36	160*i*	40	2½*i*	45
F.	Quesnel	52 36	121 37	2,200*j*	68*j*	2½	133
F.	Seton	50 30	121 59	777	14	1	10
T.	Shuswap	50 52	119 34	1,133	85*k*	2½	123
P.C.	Sigutlat (tr. Lean)	52 54	126 12		8	2	10
K.	Slocan	49 45	117 28	1,762	25	1½	24
V.I.	Sproat	49 18	124 56	70	14	1½	19
F.	Stave {normal level*	49 18	122 18	231	9	1¾	10
	Stave {ultimate level	49 14	122 21	269	18	1¾	24

d. Surface broken by large islands. Maximum width of lake about 12 m.
e. Large island at widest part, maximum width of lake about 5 m.
f. Length does not include Clayoquot arm, 8 m. long by 1 m. wide.
g. Length does not include West arm, 21 m. long by 1 m. wide.
h. Controlled for storage.
i. Controlled for storage, large island in centre, maximum width of lake 8 m.
j. Controlled to some extent by a dam at outlet. Length does not include North arm, 19 m. long by 1½ m. wide.
k. Length includes length of various arms.

*Stave lake: Extreme low level, state of nature, 226·5; extreme high level, state of nature, 243·5; normal level, state of nature (with river discharge equal to mean flow), 230·7; estimated flow line for maximum economic height of dam, 264, datum is mean sea level.

District	Lake	Situation of outlet		Elevation	Length	Width	Area
		Lat. N. ° ′	Long. W. ° ′	feet	miles	miles	sq. m.
F.	Stuart (tr. Nechako)	54 26	124 16	2,200	46	6	152
F.	Sumas	49 06	122 06	9	6	4	14
Y.	Tagish (tr. Lewes)	60 15	134 15	2,161	65*l*	2	116*l*
F.	Tahtsa (tr. Nechako)	53 36	126 44	2,650	25	3	50
P.C.	Taltapin (tr. Babine)	54 23	125 28		16	1¾	23
F.	Takla (tr. Stuart)	55 04	125 30	2,270	60*m*	3	150
F.	Taseko (tr. Chilcotin)	51 29	123 41	4,200	16	1¼	15
F.	Tatla (tr. Chilcotin)	52 05	124 10	3,018	21	¾	12
P.C.	Tatlayako (tr. Homathko)	51 26	124 27	2,723	14	1¼	13
F.	Tatuk (tr. Chilako)	53 30	124 08		11	1¼	13
M.	Tchentlo (tr. Parsnip)	55 12	124 47	2,415	22	1¾	27
F.	Tchesinkut (tr. Nechako)	54 04	125 26	2,391	11	1¾	14
Y.	Teslin	60 29	133 17	2,600	83*n*	3½	156*n*
F.	Tetachuck (tr. Nechako)	53 22	125 38	2,770	18	1½	25
F.	Tezzeron (tr. Stuart)	54 47	124 35	2,255	14	3	35
M.	Thutage (tr. Findlay)	56 59	127 05		15	1	14
F.	Trembleur (tr. Stuart)	54 49	124 57	2,245	20	3	45
K.	Trout (tr. Kootenay)	50 31	117 17	2,347	14	1¼	12
M.	Tsayta (tr. Parsnip)	55 26	125 22		12	1	10
C.	Upper Arrow	50 08	117 49	1,383	47	2¾	88
T.	Upper Clearwater	See Hobson					

l. Area of lake in B.C. 66 sq. m., in Yukon 50 sq. m. Length in B.C. 45 m.
m. Additional length of Northwest arm, 22 m.
n. Area in B.C. 54 sq. m.; in Yukon 102 sq. m. Length in B.C. 37 m.

Résumé and Summary In this chapter we have now considered some of the broad principles which should guide in connection with decisions respecting the proposed development of water-powers; let us briefly review these :

First—Governments have been bestowing increasing attention upon the investigation of inland water resources and, during recent years, Canada has made great advancement in this work. Such work is essential in order to acquaint interested parties with the possibilities of the powers with which they may be dealing.

Second—A number of factors, such as character of use, uniformity of flow, the making of but partial development in a manner prejudicial to future complete utilization, failure rightly to differentiate between primary power and secondary power, etc., have been noted and attention drawn to the necessity for reckoning with such factors.

Third—Hydrometric data extending over a sufficient period of time should be available, and conclusions involving important procedure should not be predicated upon scattered and insufficient records. Topographic maps should also be available.

Fourth—Those interested from the standpoint of the investor may, by the expenditure of ordinary effort, place themselves in a position, independently, to check and form a judgment respecting some of the basic engineering factors involved in any power project under consideration.

Fifth—Failure rightly to assemble or interpret essential physical data, has been responsible for many serious failures, and has resulted in great financial loss.

Sixth—No reliance should be placed upon general statements setting forth the existence of vast undeveloped water-powers. The total amount of water-power capable of economic development is much less than popularly assumed and most of the valuable sites are already under development or control by various interests. Attention has been directed to the concentration of control of water-powers as proceeding rapidly in the United States, and the need has been pointed out that those interested in the conservation of our water-powers should be alert to see that the same menace to public welfare does not operate in Canada. Much of this concentration of control has taken place during a time when general statements representing the existence of large reserves of potential water-power were being presented to the attention of the public and were receiving general acceptance.

Seventh—The importance of storage has been pointed out, and the possibilities of storage causing damage to riparian owners has been emphasized. Government provision for a flowage easement along the shores of lakes and rivers, would to some extent protect settlers against loss, and would protect the government itself against claims for damage by overflow.

Many of the features touched upon have been safeguarded in the comprehensive water legislation of the Province of British Columbia—a subject dealt with in the following chapter.

CHAPTER III

Historical Survey of Water Legislation in British Columbia

IN British Columbia the situation relating to the use of inland waters is a complex one. Indeed, no province of the Dominion presents so many difficulties in connection with the uses and administration of its waters.

Adequate understanding of the various rights and privileges which appertain to the use of the inland waters of British Columbia is impossible unless the laws and regulations proclaimed to deal with the early mining conditions as they arose and developed in the province in the later 'fifties' of last century are taken into consideration.

Since the granting of the first water privileges in the late 'fifties,' followed as they were by rights conferred for agricultural and other purposes, the various records and licenses for water have increased, until now, in one form or another, upwards of 7,000 records have been issued. It is obvious, therefore, how complex must be the situation which has resulted from the conferring of so many rights and privileges, the provisions of which, with respect to terms and other conditions, are so diverse.

In addition to the Ordinances and Regulations which were early issued applicable to the use of water, more especially for mining, certain Proclamations for the alienation and possession of Crown lands contained provisions governing the use of water. Many provisions of these earlier enactments are still of force, and require to be reckoned with wherever power, irrigation, or other projects involving the use of the waters or the lands to which the earlier enactments apply, are being developed. It is important, therefore, that the early Proclamations, Statutes, Rules and Regulations be clearly understood.

As needs for water multiplied, provisions governing its usage, chiefly for mining and agricultural pursuits, were placed in the Mineral Act, the Placer Act and in the Land Act. Besides these main enactments, others, as for example, the Water Viewers Act, and the Streams and Water Courses Act, were passed, containing provisions applying to special water matters. Subsequently, with the extension of the various fields to which these Acts applied, it was found necessary to amend and consolidate all the various Acts containing provisions relating to water. This was first comprehensively done in the Water Clauses Consolidation Act, 1897.

The present Water Act of British Columbia is a voluminous document of some 300 sections. It is a noteworthy measure and vests in the Government, by statutory laws, the absolute control of the inland waters of the province. A well known author, in the last edition of his *Law of Irrigation and Water Rights*, after reviewing the status of water legislation in other countries and

having devoted considerable space to the Water Act of British Columbia, respecting this statute, says :

"The Water Law is drastic and covers the subject of the title to and the use of waters in its most minute details. In fact, we consider it one of the most effective statutory laws upon the subject in existence, and undoubtedly it will stand the test of both time and all the litigation, under the Canadian form of government, that may be brought against it."*

Now, it is not possible to possess a comprehensive, nor even an adequate, understanding of the water laws of British Columbia, as they to-day exist, without a knowledge of the various individual parts of separate Acts which constitute component parts of the consolidated laws. In this chapter the various governmental water measures are reviewed, briefly, and, as far as possible, in chronological order. In making this survey, only the salient features of the more important legislation are quoted. Appended to this chapter will be found a fuller list of the Proclamations, Rules and Regulations and various Acts, as well as the numbers of the sections in these measures which contain special reference to water. This table will facilitate more detailed reference and study.

Early British Columbia Laws and the Hudson's Bay Co.

On May 30, 1838, a royal license of exclusive trade was issued to the Hudson's Bay Company, for the sole and exclusive privilege of trading with the Indians in such parts of North America to the northward and to westward of the lands and territories belonging to the United States of America, "as should not form any part of the Crown provinces then existent in North America, or of any lands or territories belonging to the United States, or to any European Government, State or Power."

August 2, 1858, the Imperial Government passed an Act,† 21-22 Victoria, Chap. 99, providing for the government of the colony of British Columbia. The Act recited that, as divers of Her Majesty's subjects had, by license and consent of Her Majesty, resorted to and settled on certain wild and unoccupied territories on the northwest coast of North America, commonly known by the new designation of New Caledonia, and from and after the passing of the Act to be named British Columbia, and the islands adjacent, for mining and other purposes, it was desirable to make some temporary provision for the civil government of such territories until permanent settlement was established, and the number of colonists increased. The Act provided that the boundaries of British Columbia should, for the purposes of the Act,

* *Treatise on the Law of Irrigation and Water Rights*, by Clesson S. Kinney, 2nd Edition, 4 vols., San Francisco, 1912, Vol. I., p. 384.

† See also *Proclamation*, British Columbia, November 19, 1858.

Author's Note—Copies of the early Proclamations, Ordinances, Rules and Regulations, and Statutes of British Columbia are quite rare. In a few instances, in preparing this historical survey, it was considered advisable to quote some of the sections in full, partly because of the difficulty that would be experienced in consulting some of the Acts, owing to their scarcity. The numbers given in the schedule which follows are those contained in the bound copy of the early Proclamations on file in the vault of the Attorney-General of British Columbia. A copy is also to be found in the Library of Parliament, Ottawa.

Plate 5

SIMILKAMEEN RIVER POWER PLANT OF THE DALY REDUCTION CO.
Showing forebay, steel penstock and power house. Head developed, 67 feet. Hedley, B. C.

WESTERN CANADA POWER CO. STAVE FALLS DEVELOPMENT

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"Be held to comprise all such Territories within the Dominions of Her Majesty as are bounded to the South by the Frontier of the United States of America, to the East by the main Chain of the Rocky Mountains, to the North by Simpson's River, and the Finlay Branch of the Peace River, and to the West by the Pacific Ocean, and shall include Queen Charlotte's Island, and all other Islands adjacent to the said Territories except as hereinafter excepted."

This Act provided, also, for the appointment of a Governor empowered to make provision for the administration of justice, and generally to make, ordain and establish all such laws, institutions and ordinances as may be necessary for the peace, order and good government of Her Majesty's subjects in the colony.

On September 2, 1858, the Crown, in so far as the said grant embraced or extended to the territories comprised within the colony of British Columbia, revoked the license of May 30, 1838, to the Hudson's Bay Company. The revocation stated that :

"*Whereas*, it has appeared to Us expedient that the right of exclusive trade with the Indians given by Us, in manner aforesaid, to the Governor and Company of Adventurers trading to Hudson's Bay, and their successors, within the territories in the said instrument described, should no longer be exercised by them within so much of those territories as is comprised within the said Colony of British Columbia

"Now, know ye, that We do hereby revoke Our said Grant contained in the hereinbefore recited Instrument of the thirtieth day of May, One thousand, eight hundred and thirty-eight, in so far as the same embraces or extends to the territories comprised within the said Colony of British Columbia ;

"And We do hereby declare that this present revocation of Our said Grant shall take effect within the said Colony as soon as it shall have been proclaimed there by the Officer administering the Government thereof."

The Proclamation for the revocation of the license to the Hudson's Bay Company was issued by the first Governor, James Douglas, on November 3, 1858.

November 19, 1858, the Governor issued a Proclamation stating that he enacted and proclaimed that each act, matter, or thing *bona fide* done and performed for any of the purposes necessary for the establishment and maintenance of peace, order, and good government, and for the protection of the rights of revenue from lands belonging to Her Majesty, prior to the Proclamation, by the said James Douglas, or any other person, or persons, acting under his authority or direction, shall be deemed to be, and to have been, valid in law.

The Act of August 2, 1858, specifically declares that no part of the colony of Vancouver's Island, "as at present established," shall be comprised within British Columbia for the purpose of the Act. The Act, however, contemplated and provided for the possibility of the subsequent incorporation of Vancouver Island with British Columbia. Until the union of Vancouver Island and British Columbia, on November 19, 1866, two separate and distinct sets of Proclamations were issued.

Proclamation, Feb. 14, 1859

February 14, 1859, a proclamation was issued relating to the alienation and possession of lands in British Columbia. It declared that "all the lands in British Columbia, and all the mines and minerals therein, belong to the Crown in fee."*

And it was further declared by section 6,† regarding the leading of water, that :

"Unless otherwise specially notified at the time of sale, all such sales of Crown land shall be subject to such public rights-of-way as may at any time after such sale, and to such private rights-of-way, and of leading or using water for animals, and for mining and engineering purposes, as may at the time of such sale be specified by the Chief Commissioner of Lands and Works."

And section 9 provides that :

"Until further notice gold claims and mines shall continue to be worked subject to the existing regulations."

Proclamation, August 31, 1859

August 31, 1859, a Proclamation, the Gold Fields Act, 1859, was issued. Section VIII, respecting priority of title, provides, subject to certain limitations, that:

"In case of any dispute, the title to claims, leases of auriferous earth or rock, ditches and water privileges, will be recognized according to the priority of registration subject only to any question which may be raised as to the validity of any particular act of registration."

Section XI, in providing for mining leases involving the use of water, states that :

"Leases of any portion of the waste lands of the Crown may be granted for mining purposes, for such term of years, and upon such conditions as to rent, and the mode of working, and as to any water privileges connected therewith, and otherwise in each case, as shall be deemed expedient by His Excellency the Governor."

Section XII, providing for the making of rules and regulations relating to water privileges, states that :

"In respect to any place or district wherein there shall for the time being be no Mining Board as hereinafter described, or any separate mine within such place or district, it shall be lawful for His Excellency the Governor, by writing under his hand and the Public Seal of the Colony, from time to time to make rules and regulations in the nature of by-laws, concerning all matters relating to claims and ditch and water privileges, and leases of the auriferous lands in the Colony in larger quantities than the claims herein mentioned or referred to, and for the registration thereof so far as such matters are not herein defined and set forth."

Section XVI, respecting disputes, further provides that:

"All disputes relating to the title to any mine or claim, or to any part of the proceeds thereof, or relating to any ditch or water privilege, or to any contract for labour to be done in respect of a ditch or water privilege, mine, or claim, or relating to the mode of carrying on the same, or any of them,

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* For interesting reference to early mining activities in British Columbia, see Begg, *History of British Columbia*, chap. XIV.

† *Editor's Note.*—The terms 'section' and 'clause' and Roman numerals or Arabic figures are printed as they appear in the original copies.

and all disputes concerning partnerships in any mine or claim, may be investigated, in the first instance, before the Gold Commissioner, having jurisdiction as aforesaid, without any limit to the value of the property or subject matter involved in such dispute."

Rules and Regulations September 7, 1859

Pursuant to the passage of the Gold Fields Act, 1859, Rules and Regulations for the Working of Gold Mines were issued September 7, 1859. The provisions of these early regulations are the first which apply more specifically to the use of waters in British Columbia, and these may be said to constitute the basis of the present water laws of the province.

A perusal of sections VII to XI, and XVIII and XIX, of the *Rules and Regulations* clearly shows the scope of this early provincial law, as it relates to waters. Section VII declares that, in making application for water privileges:

"Any person desiring any exclusive ditch or water privilege, shall make application to the Gold Commissioner having jurisdiction for the place where the same shall be situated, stating for the guidance of the Commissioner in estimating the character of the application, the name of every applicant, the proposed ditch head, and quantity of water, the proposed locality of distribution, and if such water shall be for sale, the price at which it is proposed to sell the same, the general nature of the work to be done, and the time within which such work shall be complete; and the Gold Commissioner shall enter a note of all such matters as of record.

Section VIII, respecting rental, provides that

"Unless otherwise specially arranged, the rent to be paid for any water privilege shall be in each month one average day's receipts, from the sale thereof, to be estimated by the Gold Commissioner with the assistance, if he shall so think fit, of a jury."

Section IX, requiring that water applied for must actually be used, states that:

"If any person shall refuse or neglect to take within the time mentioned in his application, or within such further time (if any) as the Gold Commissioner may, in his discretion, think fit to grant for the completion of the ditch the whole of the water applied for, he shall, at the end of the time mentioned in his application, be deemed entitled only to the quantity actually taken by him, and the Gold Commissioner shall make such entry in the register as shall be proper to mark such alteration in the quantity, and may grant the surplus to any other person according to the rules herein laid down for the granting of water privileges."

Section X provides against unreasonable use, or wilful waste, by requiring that:

"Every owner of a ditch or water privilege shall be bound to take all reasonable means for utilizing the water granted to and taken by him. And if any such owner shall wilfully take and waste any unreasonable quantity of water, he shall be charged with the full rent as if he had sold the same at a full price. And it shall be lawful for the Gold Commissioner, if such offence be persisted in, to declare all rights to the water forfeited."

Section XI provides for an equable sale and distribution of water by stating that:

"It shall be lawful for the owner of any ditch or water privilege to sell and distribute the water conveyed by him to such persons, and on such terms as they may deem advisable, within the limits mentioned in their application.

Provided, always, that the owner of any ditch or water privilege shall be bound to supply water to all applicants, being free miners, in a fair proportion, and shall not demand more from one person than from another, except when the difficulty of supply is enhanced. Provided, further, that no person, not being a free miner, shall be entitled to demand to be supplied with water at all."

Section XVIII respects the rights of other water users by stating that:

"Any person desiring to acquire any water privilege shall be bound to respect the rights of parties using the same water, at a point below the place where the person desiring such new privilege intends to use it."

Section XIX further provides for rights of priority by requiring that:

"Any person desiring to bridge across any stream or claim or other place for any purpose or to mine under or through any ditch or flume, or to carry water through or over any land already occupied by any other person may be enabled to do so in proper cases with the sanction of the Gold Commissioner. In all such cases the right of the party first in possession whether of the mine or of the water privilege is to prevail, so as to entitle him to full compensation and indemnity. But wherever due compensation by indemnity can be given, and is required, the Gold Commissioner may sanction the execution of such new work on such terms as he shall think reasonable.'

It will be seen that these early enactments embrace a principle basic to the provisions of the Water Act in the form in which it is now of force in British Columbia. That is, what may be termed *the principle or doctrine, of beneficial use.*

It will also be observed that no one party was permitted to usurp rights to the unjust exclusion of the rights of others. Note, for example, the statement in section IX, that, if any person failed to use the water covered by his application, the Gold Commissioner could restrict him to the quantity actually taken. Every owner of a ditch or water privilege was bound to take all reasonable means for utilizing the water granted to him. In fact, the wise principle that the water must not only be used, but *economically* and *beneficially* used, is clearly present in these early regulations ; and this doctrine has carefully been retained in the later water acts.

Proclamation, January 4, 1860

January 4, 1860, a Proclamation relating to the acquirement of land in British Columbia was issued. Section 16, relating to the carrying of water upon, under or over land, enacts that :

"Water privileges, and the right of carrying water for mining purposes, may, notwithstanding any claim recorded, purchase or conveyance aforesaid, be claimed and taken, upon, under or over the said land, so pre-empted or purchased as aforesaid, by free miners requiring the same, and obtaining a grant or license from the Gold Commissioner, and paying a compensation for waste or damage to the person whose land may be wasted or damaged by such water privilege, or carriage of water, to be ascertained, in case of dispute, in manner aforesaid."

Rules and Regulations, January 6, 1860

January 6, 1860, Rules and Regulations for the Working of Gold Mines, were issued supplementary to those of September 7, 1859. Section VI, respecting the measurement of water provided that :

"In order to ascertain the quantity of water in any ditch or sluice, the following rules shall be observed, *viz.*,

"The water taken into a ditch shall be measured at the ditch head. No water shall be taken into a ditch except in a trough whose top and floor shall be horizontal planes, and sides parallel vertical planes : such trough to be continued for six times its breadth in a horizontal direction from the point at which the water enters the trough. The top of the trough to be not more than 7 inches, and the bottom of the trough not more than 17 inches below the surface of the water in the reservoir, all measurements being taken inside the trough and in the low water or dry season. The area of a vertical transverse section of the trough shall be considered as the measure of the quantity of water taken by the ditch.

"The same mode of measurement shall be applied to ascertain the quantity of water running in a trough or out of any ditch."

Vancouver Island Proclamation, February 19, 1861

Section XVIII of a Proclamation for the colony of Vancouver Island, issued February 19, 1861, provides for the saving of water privileges for mining purposes. It states that :

"Water privileges, and the right of carrying water for mining purposes, may, notwithstanding any claim recorded, certificate of improvement, or conveyance aforesaid, be claimed and taken upon, under, or over the land, so pre-empted by miners requiring the same, and obtaining a grant or license from the Surveyor-General in that behalf, and paying a compensation for waste or damage to the person whose land may be wasted or damaged by such water privilege or carrying of water, to be ascertained in case of dispute by a jury of six men in manner aforesaid."

Pre-emption Consolidation Act, 1861

In a Proclamation, the Pre-emption Consolidation Act, 1861, issued August 27, 1861, sec. XXVII was essentially the same as sec. 16 of the Proclamation of January 4, 1860, already quoted.

Rules and Regulations, September 29, 1862

September 29, 1862, the Rules and Regulations under the Gold Fields Act, 1859, were supplemented by further sections providing for cases in which roads or works come into conflict with ditches, or other mining rights. The new sections, having relationship to the exercise of water privileges, are comprised in sections VIII to XII inclusive, and are as follows :

Respecting the disposal of surplus water, section VIII provides that :

"The owners of every ditch, water privilege, or mining right, shall at their own expense construct, secure, and maintain all culverts necessary for the passage of waste and superfluous water flowing through or over any such ditch, water privilege, or right, except in cases where a natural stream or river applicable or sufficient for the purpose exists in the immediate vicinity."

Section IX, respecting safety of ditch constructions, requires that :

"The owners for the time being, not being the Government, of any ditch or water privilege, shall construct and secure the same in a proper and substantial manner, and maintain the same in good repair, to the satisfaction of the Gold Commissioner, and so that no damage shall occur during their ownership thereof to any road or work in its vicinity from any part of the works of such ditch, water privilege, or right giving way by reason of not being so, as aforesaid, constructed, secured, or maintained."

Section X states that :

"The owners of any ditch, water privilege, or right, shall be liable, and shall make good, in such manner as the said Gold Commissioner shall determine, all damages which may be occasioned by or through any parts of the works of such ditch, water privilege, or right giving way as aforesaid, and the same may be recovered before a Magistrate in a summary manner."

Section XI, respecting the publication of notice, states that :

"The publication of any written notice to the party intended to be affected thereby in two consecutive issues of the *Government Gazette*, or any newspaper circulating in the Colony, or by affixing the same for seven days on some conspicuous part of any premises referred to in any such notice, shall be deemed good and sufficient notice for all purposes under the said Gold Fields' Act, 1859, and any Rules and Regulations made in pursuance thereof."

And section XII provides for public right-of-way by requiring that :

"Nothing herein contained shall be construed to limit the right of the Chief Commissioner of Lands and Works to lay out from time to time the public roads and ways of the Colony across, through, along, or under any ditch, water privilege or mining right, in any unsurveyed Crown land, without compensation, doing as little damage as conveniently may be in laying out the same."

Rules and Regulations, February 24, 1863

February 24, 1863, the Rules and Regulations issued in conformity with the Gold Fields Act, 1859, were further amended and supplemented.

Section IV, requiring that water shall be available, states :

"In addition to the above rights, every registered free miner shall be entitled to the use of so much of the water flowing naturally through or past his claim as shall in the opinion of the Gold Commissioner be necessary for the due working thereof."

Section V, respecting exclusive water privileges, requires that :

"Where application is intended to be made for the exclusive grant of any surplus water to be taken from any creek or other locality, every such applicant shall in addition to the existing requirements affix a written notice of all the particulars of his application upon some conspicuous part of the premises to be affected by the proposed grant, for not less than 5 days before recording the same.

"The Gold Commissioner, upon protest being entered or for reasonable cause, shall have power to refuse or modify such application or grant either partially or entirely, as to him shall seem just and reasonable.

"Every exclusive grant of a ditch or a water privilege in occupied or unoccupied creeks, shall be subject to the rights of such registered free miners as shall then be working, or shall thereafter work in the locality from which it is proposed to take such water."

Gold Fields Act, 1863

March 25, 1863, the Gold Fields Act, 1859, was amended. Sections IV and V, above quoted, appeared in the same form, but separated and numbered as sections 3, 4, 5 and 6.

Mining Drains Act, 1864

The Mining Drains Act, 1864, of February 1, was an ordinance to promote the drainage of mines. It provides, under section IX, that "no such grant, or license, or agreement therefor, shall be

valid unless the same shall contain a reservation of the public rights-of-way and water, in such manner, direction, and extent as the Gold Commissioner shall from time to time direct," and it was declared to be lawful for the Gold Commissioner of any district in the Colony, upon proper application, to grant full license and authority to any free miner or miners, company, or companies of free miners, to enter into and upon any lands in British Columbia, for the purpose of constructing a drain or drains for the drainage of mining ground.

Gold Fields Act, 1864

The Gold Fields Act, 1864, assented to February 26, further amends the Gold Fields Act of 1859. This new ordinance devotes considerable attention to who shall constitute a 'bed-rock flume company,' and to the rights and privileges, limitations and restrictions under which such a company may operate. Section 10 defines a 'bed-rock flume company,' as follows :

"Three or more free miners may constitute themselves into a bed-rock flume company within the meaning of this Act, and when duly authorized, as lastly hereinbefore mentioned, may enter upon any river, creek, gulch, ravine, or other water course in the Colony for the purpose of constructing and laying a bed-rock flume therein, and when not otherwise expressed in such authority as aforesaid, with the rights and privileges and under the limitations and restrictions hereinafter specified."

Section 16, relating to rivers, creeks, etc., which are not deemed to be abandoned, states that :

"Any portion or part of any river, creek, gulch ravine, or other water course having four or more free miners per mile legally holding and *bona fide* not colourably working claims, on such stream, gulch, ravine, or water course, shall not be deemed 'abandoned' within the meaning of this Act, but in such case any bed-rock flume company desiring to run a flume through such portion or part of such stream, gulch, ravine, or water course, shall be governed by the following clauses of this Act."

Inland Navigation Ordinance, 1864

The Inland Navigation Ordinance, 1864, assented to May 4, relates to the navigation of inland waters. In sections XVI and XVII, provision is made for the description and provisional definition of what may constitute 'inland waters' within the purview of the ordinance. The sections are as follows :

Section XVI provides that :

"In case of any doubt hereafter arising as to what shall be deemed to be inland waters within the meaning of this Ordinance, and for the purposes thereof, it shall be lawful for the Governor, or other Officer aforesaid, by any order to be published in the *Government Gazette*, more particularly to define the same."

Section XVII provides that :

"In the absence of any such order, all harbours, rivers, lakes, inlets, and other navigable waters within the ordinary coast line of the colony, from headland to headland, disregarding irregularities shall be deemed to be inland waters for the purposes of this Ordinance."

Gold Mining Ordinance, 1865

March 28, 1865, an Ordinance was passed to amend and consolidate the Gold Mining Laws. This consolidation represents a marked advance in the evolution of the provincial law relating both to mining and to the use of water.

The Act, itself, as does the present Water Act, declares that it is to be divided into certain parts. These are as follows: The first part relates to the appointment of Gold Commissioners and their jurisdiction; the second to free miners and their privileges; the third to the registration of claims and free miners' general rights; the fourth to the nature and size of claims; the fifth to bed-rock flumes; the sixth to the drainage of mines; the seventh to mining partnerships and limited liability; the eighth to administration; the ninth to leases; the tenth to ditches; the eleventh to mining boards and their constitution; and the twelfth to the penal and saving clauses. Under the tenth heading of 'Ditches' we find assembled in twenty-seven clauses the chief provisions relating to the application for and use of water.

This Ordinance, while bestowing the maximum amount of latitude to *bona fide* applicants for, and to users of, water, nevertheless most definitely maintains the doctrine of beneficial use. The right of the Government, from time to time, to lay out the public roads of the colony across, through, along, or under any ditch, water privilege, or mining right in any unsurveyed Crown land, without compensation, is expressly reserved. Every owner of a ditch, or water privilege, is required to construct his works in a proper and secure manner, and is made liable for any damage resulting from failure in this respect. The priority of water privileges in any way being lawfully enjoyed by any person, is to be fully respected, but provision is made whereby persons in need of water must receive same on fair terms, if available for purchase from the owner of any water privilege.

Some of these matters, so characteristic of provisions in the present Water Act, may best be understood by quoting from a few sections of this important Ordinance. Section 29, respecting the use of surplus water, provides that:

"Every registered free miner shall be entitled to the use of so much of the water naturally flowing through or past his claim, and not already lawfully appropriated, as shall, in the opinion of the Gold Commissioner, be necessary for the due working thereof."

Subject to certain requirements with respect to an application, such as, that it shall be in writing; a deposit accompany it; and that sufficient public notice be given, section 99 provides that:

"It shall be lawful for the Gold Commissioner, upon the application hereinafter mentioned, to grant to any person for any term not exceeding five years, the right to divert and use the water from any creek, stream, or lake, at any particular part thereof, and the right-of-way through and entry upon any mining ground in his district, for the purpose of constructing ditches and flumes to convey such water."

With respect to the rights of priority, section 104 provides that:

"Every grant of a ditch, or water privilege in occupied creeks, shall be subject to the right of such registered free miners as shall at the time of such grant be working on the streams above or below the ditch head, and of any

other person or persons whatsoever who are then in any way lawfully using such water, for any purpose whatsoever."

That the water shall not only be used beneficially, but also that it shall not be wilfully nor unreasonably wasted, is provided for by section 108, which states :

"Every owner of a ditch or water privilege shall be bound to take all reasonable means for utilizing the water granted and taken by him. And if any such owner shall wilfully take and waste any unreasonable quantity of water he shall be charged with the full rent as if he had sold the same at a full price. And it shall be lawful for the Gold Commissioner, if such offense be persisted in, to declare all rights to the water forfeited."

Section 109 provides for a fair distribution of water to other free miners :

"It shall be lawful for the owner of any ditch or water privilege to distribute for use the water conveyed by him to such persons, and on such terms as he may deem advisable, within the limits mentioned in their application. Provided, always, that the owner of any ditch or water privilege shall be bound to supply water to all applicants being free miners, in a fair proportion, and shall not demand more from one person than another, except where the difficulty of supply is enhanced."

With respect to the measurement of water, section 112 states :

"In measuring water in any ditch or sluice, the following rules shall be observed :—The water taken into a ditch shall be measured at the ditch head with a pressure of seven inches. No water shall be taken into a ditch except in a trough placed horizontally at the place at which the water enters it. The aperture through which the water passes shall not be more than ten inches high. The same mode of measurement shall be applied to ascertain the quantity of water running out of any ditch into any other ditch or flume."

The quotations just given demonstrate the direct influence these early provisions have had upon those which, to-day, are included in the present Water Act.

Land Ordinance, 1865

April 11, 1865, the Land Ordinance, 1865, was enacted. It repealed the Mining District Act, 1863, and the Pre-emption Consolidation Act, 1861. This new Ordinance, which, it will be noted, is respecting 'land,' sets forth some very important provisions relating to waters. First, section 8, relating to the preservation of rights-of-way, provides that :

"Unless otherwise specially notified at the time of sale, all Crown lands sold shall be subject to such public rights-of-way as may at any time after such sale be specified by the Chief Commissioner of Lands and Surveyor General, and to such private rights-of-way, and of leading or using water for animals, and for mining and engineering purposes, as may at the time of such sale be existing."

Section 24, with respect to the possible use of water courses, or such other natural objects as boundaries, provides that :

"Where the land sought to be acquired is in whole or in part bounded by mountains, rocks, lakes, swamps, or the margin of a river, or by other natural boundaries, then such natural boundaries may be adopted as the boundaries of the land sought to be acquired, and in such case it shall be

sufficient for the claimant to show to the satisfaction of the Stipendiary Magistrate of the district, that the said form conforms as nearly as circumstances permit to the provisions of this Ordinance."

Regarding the saving of miners' rights, section 40 provides that :

"Nothing herein contained shall be construed as giving a right to any claimant to exclude free miners from searching for any of the precious minerals, or working the same ; but in case of any entry being made upon lands held as aforesaid, full compensation shall be made, or adequate security therefor be given, to the satisfaction of the Stipendiary Magistrate of the district, prior to such entry, to the occupant for any loss or damage he may sustain by reason of any such entry ; such compensation to be determined by the Stipendiary Magistrate or Gold Commissioner of the district, with or without a jury of not less than five, in the discretion of such Magistrate or Commissioner."

And more particularly, under the heading of 'Water,' it makes provisions which are so important that sections 44 to 50, inclusive, are here quoted in full.

Section 44, providing for the diversion of water, states that :

"Every person lawfully occupying and *bona fide* cultivating lands may divert any unoccupied water from the natural channel of any stream, lake, or river adjacent to or passing through such land, for agricultural and other purposes, upon obtaining the written authority of the Stipendiary Magistrate of the district for the purpose, and recording the same with him, after due notice as hereinafter mentioned, specifying the name of the applicant, the quantity sought to be diverted, the place of diversion, the object thereof, and all such other particulars as such Magistrate may require."

Section 45 provides for the giving of notice by requiring that :

"Previous to such authority being given, the applicant shall post up in a conspicuous place on each person's land through which it is proposed that the water should pass, and on the district court house, notices in writing, stating his intentions to enter such land, and through and over the same to take and carry such water, specifying all particulars relating thereto, including direction, quantity, purpose, and term."

Section 46, respecting priority of right, states that :

"Priority of right to any such water privilege, in case of dispute, shall depend on priority of record."

Section 47 provides for the carrying of water by requiring that :

"The right of entry on and through the lands of others for carrying water for any lawful purpose, upon, over, or under the said land, may be claimed and taken by any person lawfully occupying and *bona fide* cultivating as aforesaid, and (previous to entry) upon paying or securing payment of compensation as aforesaid, for the waste or damage so occasioned, to the person whose land may be wasted or damaged by such entry or carrying of water."

Sections 48 and 49 provide for the settlement of disputes. It is stated that :

"In case of dispute, such compensation or any other question connected with such water privilege, entry, or carrying, may be ascertained by the Stipendiary Magistrate of the district in a summary manner, at the option of either of the contending parties, either with or without a jury of five men, to be summoned as in ordinary cases.

"It shall be lawful for such Magistrate, by an order under his hand, directed to the Sheriff or Deputy Sheriff, to summon a jury for such purpose, and in the event of non-attendance of any persons so summoned, he shall have power to impose a fine not exceeding five pounds."

Section 50 provides for the exercise of water privileges by stating that :

"Water privileges for mining or other purposes, not otherwise lawfully appropriated, may be claimed, and the said water may be taken upon, under, or over any land so pre-empted or purchased as aforesaid, by obtaining a grant or license from the Stipendiary Magistrate of the district, and previous to taking the same, paying reasonable compensation for waste or damage to the person whose land may be wasted or damaged by such water privilege or carriage of water."

Williams Creek Flume Ordinance

A private act, The Williams Creek Flume Ordinance, 1866, was passed March 16, 1866. It granted certain exclusive rights relating to water, right-of-way, and land, and, although it has had an important bearing on certain cases in the law courts, yet it is not necessary, here, to do more than direct attention to it.

Union of the Colonies

As a result of the division into two colonies, with separate governments, 12,000 or 13,000 white inhabitants were taxed nearly $95.00 per capita per annum. Loans for British Columbia were only negotiable at excessive rates of interest. The Imperial Government, therefore, decided to unite them. By the British Columbia Act, November 19, 1866, the Crown colonies of Vancouver Island and British Columbia were united. The Union Act provided that existing ordinances were to remain in force until otherwise determined by law, with certain specified exceptions respecting customs revenues and appointments.

Gold Mining Ordinance, 1867

The Gold Mining Ordinance, 1867, being Proclamation No. 34, passed April 2, 1867, need not, here, be specially reviewed, because, respecting water, its provisions correspond in text to the Gold Mining Ordinance of 1865 above referred to.

Land Ordinance, 1870

In the Land Ordinance, 1870, June 1, various Acts relating to the disposal and regulation of Crown land in British Columbia were amended and consolidated. The following ordinances and proclamations, relating to the disposal and regulation of Crown lands, were repealed : Act dated February 14, 1859 ; Act dated January 4, 1860 ; Act dated January 20, 1860 ; Pre-emption Amendment Act, 1861 ; the Country Land Act, 1861 ; Pre-emption Purchase Act, 1861 ; Pre-emption Consolidation Act. 1861 ; Mining District Act, 1863 ; Land Ordinance, 1865 ; Pre-emption Ordinance, 1866 ; Pre-emption Payment Ordinance, 1869 ; and the Vancouver Island Land Proclamation, 1862. But such repeal was not to prejudice or affect any rights acquired, or payments due, or forfeitures or penalties incurred prior to the passing of this ordinance in respect of any land in the colony.

In the Land Ordinance of 1870, sections XXX to XXXVII, inclusive, relate particularly to water. Sections XXX to XXXV, inclusive, are prac-

tically identical with, and correspond in numeral sequence to, sections 44 to 50 of the Land Ordinance, 1865, and which have been above quoted.

Section XXXVI, of the Ordinance of 1870, in effect declares recorded water privileges to be appurtenant to land acquired by pre-emption right. The section states :

"All assignments, transfers, or conveyances of any pre-emption right, heretofore or hereafter acquired, shall be construed to have conveyed and transferred, and to convey and transfer, any and all recorded water privileges in any manner attached to or used in the working of the land pre-empted."

Section XXXVII empowers the Commissioner to forfeit water rights if the owner of such is wilfully taking and wasting an unreasonable quantity of water.

Revised Laws, British Columbia, 1871

In the *Revised Laws of British Columbia*, 1871, No. 90,* sections 106 to 132, inclusive, practically consolidate the law of water, relating to 'mining'; and No. 144,† sections 30 to 37 are a corresponding consolidation for the law of water relating to 'land.'

Land Ordinance Amendment Act 1872

April 11, 1872, the Land Ordinance of 1870 was amended by the Land Ordinance Amendment Act, 1872. The provisions of the Amending Act are important. The doctrine of beneficial use is enlarged upon and is clearly set forth in sections 2, 3 and 4.

Section 2 provides for the obtaining of written authority to divert water for necessary uses. It requires that :

"Every person lawfully entitled to hold a pre-emption under the said ordinance, and lawfully occupying and *bona fide* cultivating lands, may divert so much and no more, of any unrecorded and unappropriated water from the natural channel of any stream, lake, or river adjacent to or passing through such land, for agricultural or other purposes, as may be reasonably necessary for such purposes, upon obtaining the written authority of the Commissioner of the district to that effect, and a record of the same shall be made with him, after due notice as in the said ordinance mentioned, specifying the name of the applicant, the quantity sought to be diverted, the place of diversion, the object thereof, and all such other particulars as such Commissioner may require ; for every such record the Commissioner shall charge a fee of two dollars ; and no person shall have any exclusive right to the use of such water, whether the same flow naturally through or over his land, except such record shall have been made."

No exclusive rights may be acquired except as provided by section 3, which states :

"The owner of any water privilege or right acquired by record, shall have no exclusive right to the water privilege so recorded, until he shall have constructed a ditch for conveying the water to the place where it is intended to be used. And in case any such ditch shall not be of sufficient capacity to carry the quantity of water recorded by the owner of such ditch, then the exclusive right of such owner shall be limited to the quantity which such ditch may be

* No. 90, 1871, is essentially the Gold Mining Ordinance, 1867.
† No. 144, 1871, is essentially the Land Ordinance, 1870.

capable of carrying, notwithstanding such record, until such ditch shall be enlarged so as to be capable of carrying the quantity of water recorded by such person."

Wilful waste of any quantity of water is declared to be a misdemeanor. Thus, section 4 states that :

"Any owner of any ditch or water privilege who shall wilfully waste any quantity of water, by diverting any more of it from its natural course, through any ditch or otherwise, than the quantity actually required by him for irrigation or any other purpose, shall be deemed guilty of a misdemeanor, and shall be punished by a fine not exceeding one hundred dollars for each such offence, to be recovered before a Justice of the Peace, Stipendiary Magistrate, or Commissioner, in a summary manner, and in default of payment by distress ; and no owner of any first record to any ditch or water right shall have any right to interfere with or prevent the construction of any dams, breakwaters, or other improvements made or hereafter to be made for the purpose of saving or economising the water of any creek, lake, or water-course of any kind ; provided that the construction or use of such dam or breakwater does not nor will divert such water from its proper channel, at the point or place where such owner takes the water used by him into his ditch or channel. Provided also that the construction and use of such dam or breakwater shall not injure the source from which such water is taken, or the property of any party or parties, by backing water, flooding, or otherwise. Provided also that all disputes arising upon any matter or thing in this clause contained, shall be decided in a summary manner before any Justice of the Peace, Stipendiary Magistrate, or Commissioner, who shall have full power to make such decision as shall seem to him to be just and equitable."

Land Ordinance Amendment Act, 1873

The Land Ordinance of 1870 was further amended February 21, 1873. In section 7, the amending Act refers to the posting of notice respecting water record, and, in section 19, to dyking, draining and irrigation.

Regarding the posting of notice, section XXXI, of the Act of 1870, was repealed, and in lieu thereof, section 7 of the amending Act of 1873 states that :

"Previous to such authority being given, the applicant shall post up in a conspicuous place on each person's land to be affected by the proposed diversion of any stream, lake, or river, and on the district court house, notices in writing stating his intention to enter such land and through and over the same to take and convey and divert such water (as the case may be), specifying all particulars relating thereto, including direction, quantity, purpose, and term."

Section 19, relating to the sale of vacant Crown land, states that :

"It shall be lawful for the Lieutenant-Governor in Council to sell any vacant lands of the Crown, or make free grants thereof, to any person or company, for the purpose of dyking, draining, or irrigating the same, subject to such regulations as the Lieutenant-Governor in Council shall see fit."

Drainage, Dyking and Irrigation Act, 1873

February 21, 1873, the Drainage, Dyking and Irrigation Act, 1873, was passed to provide for the dyking and draining of marsh, swamp or meadow lands. Provision was made by which proprietors of such lands might appoint commissioners, who, under the Act, were empowered to carry on work for reclaiming such lands. Provision

was also made for assessing the owners, or occupiers, of such lands for any expenses incurred by the commissioners for dykes, weirs, drains, ditches, flumes, flood-gates or breakwaters.

While this Act is not directly associated with the present Water Act, and hence not strictly within the purview of this historical survey, nevertheless, on account of the character of the Act itself, it is expedient just to direct attention to it.

Public Works Act, 1872

The Public Works Act, 1872, April 11, subject to certain restrictions, provides that the Lieutenant-Governor in Council may acquire and take possession "of any land, or real estate, streams, waters, water-courses . . . in his judgment necessary for the use, construction, or maintenance of any public work or building, or for the enlargement or improvement of any public work, or for obtaining better access thereto." (See sections 1, 2, 3, 4, and 6.)

By the Public Works Extension Act, 1873, chap. 9, February 21, the Chief Commissioner of Lands and Works is declared to have control over provincial waters not under the control of the Dominion Government. Subject to compensation (see section 19), or arbitration (see section 20), the Chief Commissioner may acquire, if neccessary by expropriation, possession of streams, waters, or water-courses. Section 6 of the Act states that :

"All land, streams, water-courses, and property, real or personal, heretofore or hereafter acquired for the use of public works ; all locks, dams, hydraulic and other works for improving the navigation of any water ; all hydraulic powers created by the construction of any public works ; all roads and bridges ; all public buildings ; all drains, drainage and irrigation works, and all property heretofore or hereafter acquired, constructed, repaired, maintained or improved at the expense of the Province, and not under the control of the Dominion Government, shall be and remain vested in Her Majesty and under the control of the Chief Commissioner of Lands and Works."

Land Act, 1874, Chap. 2

March 2, 1874, by chap. 2, the Land Act, 1874, the land laws were amended and consolidated; The Land Ordinance, 1870, and all Proclamations, Statutes, Ordinances, and Acts, thereby repealed; the Land Ordinance Amendment Act, 1872; and the Land Ordinance Amendment Act, 1873; were repealed.

Section 48, relating to who may divert waters, provides that :

"Every person lawfully entitled to hold land under this Act, or under any former Act, Ordinance, or Proclamation, and lawfully occupying and *bona fide* cultivating lands, may divert so much and no more of any unrecorded and unappropriated water from the natural channel of any stream, lake, or river adjacent to or passing through such land, for agricultural or other purposes, as may be reasonably necessary for such purposes, upon obtaining the written authority of the Commissioner of the district to that effect, and a record of the same shall be made with him, after due notice, as herein mentioned, specifying the name of the applicant, the quantity sought to be diverted, the place of diversion, the object thereof, and all such other particulars as such Commissioner may require ; for every such record the Commissioner shall charge a fee of two dollars ; and no such person shall have any exclusive right to the use of such water, whether the same flow naturally through or over his land, except such record shall have been made."

Section 49, respecting the giving of notice, provides that :

"One month previous to such authority being given, the applicant shall post up in a conspicuous place, on each person's land to be affected by the proposed diversion of any stream, lake, or river, and on the District Court House, notices in writing, stating his intention to take, and convey, and divert such water (as the case may be), specifying all particulars relating thereto, including direction, quantity, purpose, and term."

Section 50, relating to the acquirement of exclusive privilege, requires that :

"The owner of any water privilege or right acquired by record, shall have no exclusive right to the water privilege so recorded, until he shall have constructed a ditch for conveying the water to the place where it is intended to be used. And in case any such ditch shall not be of sufficient capacity to carry the quantity of water recorded by the owner of such ditch, then the exclusive right of such owner shall be limited to the quantity which such ditch may be capable of carrying, notwithstanding such record, until such ditch shall be enlarged so as to be capable of carrying the quantity of water recorded by such person."

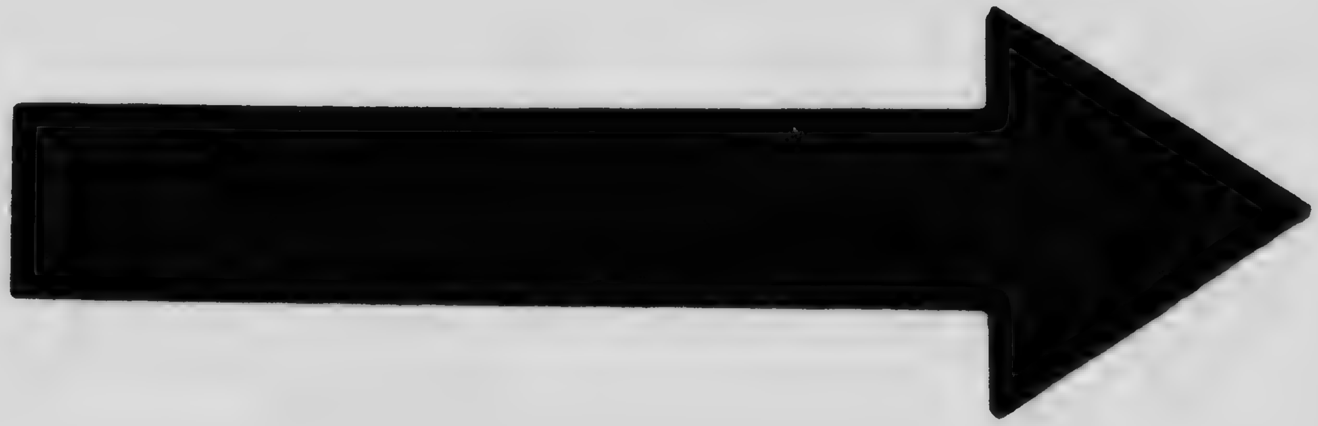
Section 51 is the same as section 46 of the Land Ordinance, 1865 ; section 52 the same as section 47 ; section 53 corresponds closely to section 48 ; as also does section 54 to section 50.

Section 55 provides against wilful waste or uneconomical use of water, and encourages conservation. The section stipulates that :

"Any owner of any ditch or water privilege who shall wilfully waste any quantity of water heretofore or hereafter acquired by record or otherwise, by diverting any more of it from its natural course, through any ditch or otherwise, than the quantity actually required by him for irrigation or any other purpose, shall be punished by a fine not exceeding one hundred dollars for each such offence, to be recovered before a Justice of the Peace, Stipendiary Magistrate, or Commissioner, in a summary manner, and in default of payment by distress, or by imprisonment for any period not exceeding six months ; and no owner of any first record to any ditch or water right shall have any right to interfere with or prevent the construction of any dams, breakwaters, or other improvements made or hereafter to be made for the purpose of saving or economizing the water of any creek, lake, or water-course of any kind : Providing, that the construction or use of such dam or breakwater does not nor will divert such water from its proper channel, at the point or place where such owner takes the water used by him into his ditch or channel : Provided, also, that the construction and use of such dam or breakwater shall not injure the source from which such water is taken, or the property of any party or parties, by backing water, flooding, or otherwise : Provided, also, that all disputes arising upon any matter or thing in this clause contained, shall be decided in a summary manner before any Justice of the Peace, Stipendiary Magistrate, or Commissioner, who shall have full power to make such decision as shall seem to him just and equitable."

Section 74 provides for the sale of Crown lands, as follows :

"It shall be lawful for the Lieutenant-Governor in Council to sell any vacant lands of the Crown, or make free grants thereof, to any person or company, for the purpose of dyking, draining, or irrigating the same, subject to such regulations as the Lieutenant-Governor in Council shall see fit."



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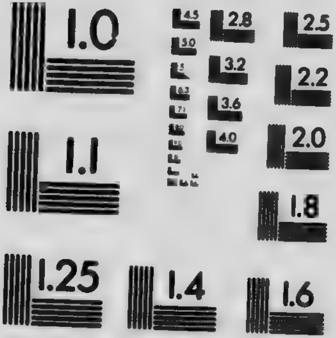


And section 81 preserves the rights of miners by stating that

"Nothing in this Act contained shall be construed so as to interfere prejudicially with the rights granted to free miners under the Gold Mining Ordinance, 1867, or any subsequent Acts or Ordinances relating to gold mining."

It will be observed, as certain sections of some of these acts are quoted, that some sections are quite similar to corresponding sections in acts previously referred to. It is necessary, however, thus to quote and requote in order that the introduction of new phrases may be seen, and the force of such be clearly understood, because it was by just such deletions, modifications, and additions that the present 'Water Act' of British Columbia was evolved.

Land Act, 1875

April 22, 1875, the laws affecting Crown lands in British Columbia were further amended and consolidated. The following were repealed: the Land Ordinance, 1870, and all Proclamations, Statutes, Ordinances and Acts thereby repealed; the Land Ordinance Amendment Act, 1873, and the Land Act, 1874. But such repeal did not, in respect of any of the land in the Province, prejudice or affect any rights acquired, or payments due, or penalties incurred, prior to the passing of this Act of 1875.

Line Fences and Water Courses Act, 1876, Chap. 14

May 19, 1876, the British Columbia Line Fences and Water Courses Act, 1876, was passed. This measure has little, if any, relationship to the present Water Act, but, on account of its title, it is advisable just to state, that it provided the means by which interested parties might open a ditch, or water course, for the purpose of letting off surplus water from swamps or low-lying lands, in order to allow the owners or occupiers to cultivate or improve same. Ditches which were opened by owners of adjoining lands frequently partook, so to speak, of the character of a boundary fence. In consequence of this fact, the Act, here referred to, may be considered more in its aspect of relating to boundary fences than to water courses, as the latter term is understood in its relationship to the present Water Act.

Consolidated Statutes, 1877

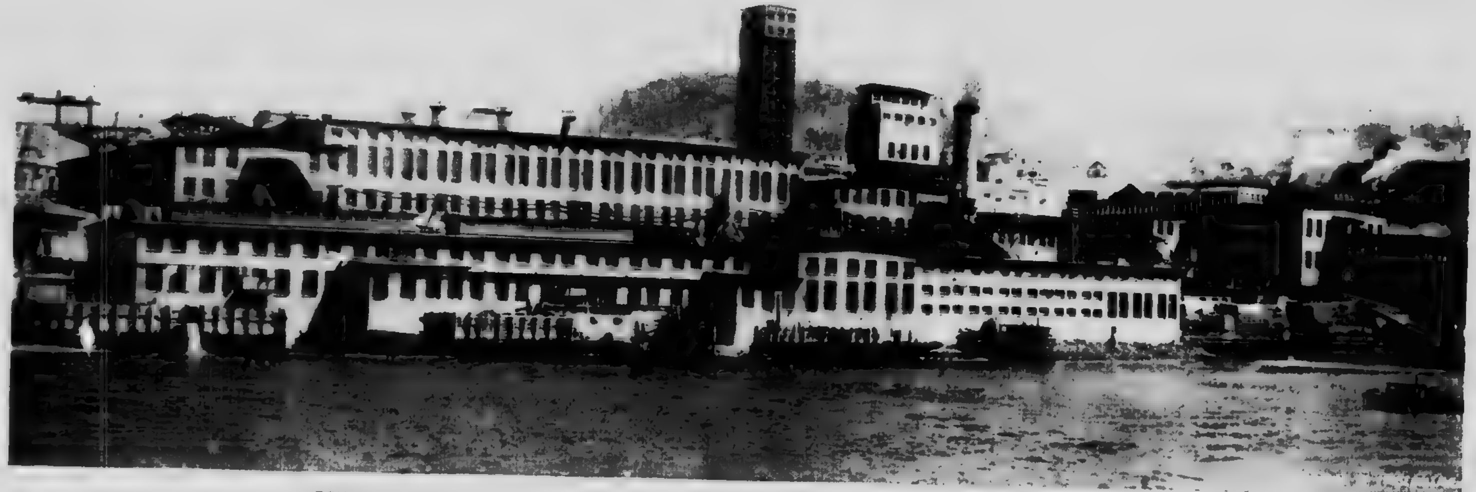
In the *Consolidated Statutes of British Columbia*, 1877, chap. 98, respecting water, corresponds to Land Act, 1875, and has for short title Land Act, 1875; and chap. 123 of 1877 corresponds to the Gold Mining Ordinance, 1867, and has for short title Gold Mining Ordinance, 1867.

Land Amendment Act, 1882, Chap. 6

April 21, 1882, the Land Amendment Act, 1882, which was to be read and construed with the Land Act, 1875, and the Land Amendment Act, 1879, provided in section 3 for the disposal of surplus water by requiring that:

"The proprietors or occupiers of any lands subject to irrigation may, with the consent in writing of the Commissioner, by means of flumes, ditches, or drains through the adjacent lands, run their surplus and waste water into any creek, gulch or channel. The Commissioner herein referred to shall mean the Chief Commissioner of Lands and Works or Assistant Commissioner: Provided further, that when such power is exercised by either of the above officers any Commissioners acting under the Drainage, Dyking and Irrigation

Plate 6



POWELL RIVER CO. PULP AND PAPER MILLS POWELL RIVER, B. C. NOTE PIPELINES ON LEFT

Acts for the time being in force, shall not be at liberty to interfere with the power so exercised. The provisions of this clause shall be subject to the provisions of the law for the time being in force respecting compensation for entry upon occupied lands for carrying water through or over them."

Section 4 defines the unit by which water in the province shall be measured, as follows :

"In measuring water in any ditch or sluice, the following rules shall be observed :—The water taken into a ditch or sluice shall be measured at the ditch or sluice head. No water shall be taken into a ditch or sluice except in a trough placed horizontally at the place at which the water enters it. One inch of water shall mean half the quantity that will pass through an orifice two inches high by one inch wide, with a constant head of seven inches above the upper side of the orifice."

Land Act, 1884, Chap. 16

The Land Act, 1884, well consolidates water legislation as contained in previous land laws. It is unnecessary to re-review them, as it will suffice to record that in the Land Act, 1884, chap. 16, under the heading 'Water,' consisting of sections 43 to 52, section 43 corresponds to section 2 of the Land Ordinance Amendment Act, 1872, No. 31; section 44 corresponds to section 45 of the Land Ordinance, 1865; section 45 to section 3 of Land Ordinance Amendment Act, 1872 ; sections 46, 47, 48 and 49, respectively, to sections 46, 47, 48 and 50 of Land Ordinance, 1865; section 50 to section 4 of Land Ordinance Amendment Act, 1872; sections 51 and 52 to sections 3 and 4 of the Land Amendment Act, 1882.

In the foregoing text of this survey will be found all the sections to which references have just been made for the Land Act of 1884.

Respecting the Mineral Act of 1882, chap. 8, and the Mineral Act of 1884, chap. 10, it will not be necessary to discuss these measures. So far as water is concerned, the Act of 1884 is practically identical with the Act of 1882 ; and the Act of 1882 closely corresponds in text to the Gold Mining Ordinance of 1867, which, respecting water, corresponds to the Gold Mining Ordinance of 1865 (Proclamation No. 14). This has already been discussed at some length.

This portion of the survey is more concerned in following the course of water legislation as it developed through the various Land Acts, because, in connection with the Land Acts are found set forth those changes in legislation which were projected into the present Water Act ; whereas the provisions of the Mining Acts experienced less change from the early Proclamation of 1865, and, moreover, the provisions of the Mining Acts subsequently were incorporated, practically as a whole, into the Water Clauses Consolidation Act, 1897.

Chapter 10, 1886

April 6, 1886, an Act to amend the Land Act, 1884, was passed. It deals with matters relating to the conveyance of water rights and privileges ; with court decisions ; with water rights imperfectly recorded ; and with rules for the measurement of water. These amendments are important, as *water is declared to be appurtenant to the land*, and all conveyances of lands are to carry with them the recorded water rights. Thus, section 1 declares that :

"All assignments, transfers, or conveyances of any pre-emption right, where the same are or were permitted by law, and all conveyances of land in fee, whether such assignments, transfers or conveyances were or shall be made before or after the passing of this Act, shall be construed to have conveyed and transferred, and to convey and transfer, any and all recorded water privileges in any manner attached to or used in the working of the land pre-empted or conveyed; and any person entitled by devise or descent to any pre-emption right or land to which any recorded water privilege was attached or enjoyed by the person or persons last possessed or seized, shall also be entitled to such water privileges in connection with the land."

Section 2 states that:

"Section 29 of the Land Act, 1884, is hereby amended by adding at the end of the section the following words:—

"'Any person dissatisfied with the decision of a Judge of the Supreme Court may appeal to the full court at Victoria, provided that notice of the appeal be given to the opposite party within thirty days from such decision, and provided, also, that the appellant give, within such period such security for costs as the Judge whose decision is appealed from may approve, and such appeal shall be dealt with as near as may be as in the case of an ordinary appeal to the full court from the decision of an action in the Supreme Court.'"

Respecting the making valid of water rights imperfectly, but *bona fide*, recorded, section 3 declares that:

"And whereas, many records of water rights and privileges have in past times been honestly, but imperfectly made, and it is desirable that such records should have legal recognition: Therefore, it is declared and enacted that in all cases where the validity of any water record heretofore made may be called in question, and the Court or Judge before whom the case is pending shall be of opinion that such record was *bona fide* made, the same shall be held to be good and valid so far as the making and entry thereof is concerned, and effect shall be given thereto according to the intent thereof."

Relating to the measurement of water, section 4 requires that:

"In measuring water in any ditch or sluice, the following rules shall be observed:—The water taken into a ditch or sluice shall be measured at the ditch or sluice head. No water shall be taken into a ditch or sluice except in a trough placed horizontally at the place at which the water enters it, and which trough shall be extended two feet beyond the orifice for the discharge of the water. One inch of water shall mean the quantity that will pass through an orifice two inches high by half an inch wide, with a constant head of seven inches above the upper side of the orifice, and every additional inch of water shall mean so much as will pass through the said orifice extended horizontally half an inch."

Section 5, respecting pending litigation, states that:

"Nothing in this Act contained shall affect any pending litigation, nor the force or operation of any judgments heretofore rendered, but otherwise this Act shall be construed with and as part of the Land Act, 1884, but not so as to validate any record for any purpose not authorized by law."

Water Viewers Act, 1886, Chap. 24

Provision had been made under the Land Act, 1884, for the establishment of districts to be known as 'Water Districts.' April 6, 1886, an Act was passed providing for the election and defining of the duties of water 'viewers.' In any water district, a water viewer

might be elected under certain conditions specified in the Act, by owners or occupiers of land in the district. Each water viewer was empowered to hear, determine and adjust all water disputes and declare matters arising within his district, upon persons who had recorded water for irrigation purposes. The power to adjudicate upon the validity of any records or claims for damages was excluded.

This Act was a move along good lines, but it was not much used, probably because of the lack of a necessary collateral governmental agency by which to make the operation of its provisions effective.

Amending Land Act, 1888, Chap. 16

April 28, 1888, An Act to Amend the Land Act, 1884, was passed. The requirements of this Act (chap. 16), relating to the proceedings by which water might be recorded, and to certain powers conferred upon the Commissioner of the district, are set forth in section 1, which is as follows :

"The Chief Commissioner of Lands and Works, with the approval of the Lieutenant-Governor in Council, may, upon such terms and conditions as to compensation to persons affected as the Chief Commissioner may think proper to impose, authorize the diversion, for the benefit of all or any of the Indians located on any Indian reserve, of so much and no more of any unrecorded and unappropriated water from the natural channel of any stream, lake, or river, adjacent to or passing through such reserve, for agricultural purposes, as may be reasonably necessary for such purposes.

"(2) No water shall be recorded under this section unless and until—

"(*a*) The provisions of the Land Act, 1884, relating to notice of application to divert and record water have been satisfied :

"(*b*) The Commissioner of the district has served or forwarded by registered letter to each person whose land may be affected by the proposed diversion a copy of the notice mentioned in section 44 of the Land Act :

"(*c*) The notice required by the provisions of the Land Act, 1884, relating to notice of application to divert and record water has been published for one month in the *British Columbia Gazette*, and in a newspaper (if any) published in the district, and if there be no newspaper published in the district, then for one month in some newspaper published in the province :

"(*d*) The Commissioner of the district has reported thereon in writing to the Chief Commissioner as to the volume of water in the creek, stream, or lake from which the water is proposed to be taken the damage or benefit likely to accrue from such diversion to the land owners or other persons having water rights on such stream, creek, or lake from which it is proposed to divert the water ; that the amount of water asked for is necessary and reasonable, and for such other particulars as the Chief Commissioner may from time to time require.

"(3) The Chief Commissioner may with the approval of the Lieutenant-Governor in Council, alter, vary, or cancel, any record made under this section, upon such terms and conditions as he may deem proper.

"(4) No authority for the diversion of water under this section shall be granted unless and until the Chief Commissioner has been satisfied that the terms and conditions as to notice have been satisfied and compensation (if ordered) has been paid.

"(5) All questions connected with the diversion of water under this section, compensation for damages, or quantity of water required, shall be decided in a summary manner by the Chief Commissioner, and the Chief Commissioner may, in writing, direct any Assistant Commissioner or Justice of the Peace to take on oath the evidence of any person who can give evidence on or whose evidence is material to the decision of the matters in question, and such Assistant Commissioner or Justice of the Peace shall have full power and authority to take such evidence and to summon before him such persons."

Consolidated Laws British Columbia, 1888, Chap. 66

The *Consolidated Laws of British Columbia* for 1888, contain, in chapter 66, the consolidation of the laws affecting Crown lands. The basis for the consolidation is the Land Act, 1884. In the portion of the Act relating to water, sections 39 to 47, inclusive, correspond to 43 to 51 in chap. 16 of 1884. Sections 48, 49, 50 and 51 correspond, respectively, to sections 4, 1, 3 and 5 of chap. 10 of the Acts of 1886 ; section 52 is derived from chap. 16 of the Act of 1888. The consolidation of the Mineral Act, chap. 82, embodies, respecting water, chap. 10 of the Act of 1884.

Rivers and Streams Act, 1890, Chap. 43

April 26, 1890, a comprehensive Act was passed, to regulate the clearing of rivers and streams. This Act, intituled Rivers and Streams Act, 1890, chap. 43, states in section 1 that :

"It shall be lawful for the Lieutenant-Governor in Council, upon receipt of a proposal from any person (in this Act referred to as 'the promoter') desirous of clearing and removing obstructions from any lake, river, creek or stream, and for making the same fit for rafting and driving thereon logs, timber, lumber, containing the terms and conditions upon which he is willing to undertake the same, to accept such proposal provisionally, but subject to any such modifications and alterations of the terms thereof as the Lieutenant-Governor in Council shall think fit."

The promoter of the proposed undertaking is given ample powers to enable him to undertake such works, subject to the making of surveys ; the providing for compensation to owners for damages ; the giving of security ; the fyling of plans, book of reference, etc., with the Chief Commissioner of Lands and Works ; the publication of specified notice; the preservation of the privileges of irrigation or milling ; the provision for persons to take advantage, on the payment of reasonable tolls, of the promoter's improvements, etc.

Placer Act, 1891, Chap. 26

April 20, 1891, the Placer Mining Act, chap. 26, was passed. The provisions which this Act contains, respecting water, consist for the most part of a combination of provisions derived from the Mineral Act and the Land Act. It provides that every free miner shall be entitled to the use of so much of the water actually flowing through or past his placer claim, and not already lawfully appropriated, as shall, in the opinion of the Gold Commissioner, be necessary for the due working thereof. Provision is made by which a free miner may obtain a grant to a water right in any unappropriated water for any placer mining purpose upon certain specific conditions. The free miner must properly post a notice in writing ; a record of the grant must be made with the Mining Recorder ; the rights of other free miners are very fully protected ; the water must actually be used beneficially and not wasted ; wilful waste may entail forfeiture of grant ;

proper and substantial ditch construction is demanded ; [illegible] wide discretionary powers are vested in the Gold Commissioner.

In cases of dispute respecting priority sections 62 and 63 provide that :

"On any dispute between applicants for a grant prior to such grant being made, priority of notice shall constitute priority of right, if any."

And

"A grant duly recorded shall speak from the date of the grant, and not from the date of the record."

The Act provides that, although a grant of a water right made in respect of any placer claim, or placer mine held as real estate, shall be deemed appurtenant to such claim or mine, nevertheless, whenever such claim or mine is worked out, abandoned or forfeited, or whenever the occasion for the use of the water upon the claim or mine shall have permanently ceased, the grant shall be at an end and determined.

The Placer Mining Act, 1891, was repealed by the Water Act, 1897, but in the last named Act will be found the essence of the provisions which we have just referred to, as applicable to free miners.

Water Privileges Act, 1892, Chap. 47

An Act to confirm to the Crown, all unrecorded and unappropriated water, and water-power in the province, and cited as the Water Privileges Act, 1892, was passed April 23, 1892.

The preamble of the Act recites that :

"Whereas, by sections 39 to 52, inclusive, of the Land Act, provision is made for the diversion and use of water from natural water-courses, and the acquisition of a right to the use of water and the conditions of such diversion and acquisition are prescribed :

"And whereas it is expedient to define and regulate the powers of companies incorporated under special Act or otherwise for the constructing and maintaining water works and electrical works, and having the power to divert, appropriate, and use streams of water for motive purposes ; and to place certain restrictions upon the acquisition of water privileges :

"Therefore, Her Majesty, by and with the advice and consent of the Legislative As[illegible] the Province of British Columbia, enacts as follows :. . . "

The [illegible]itly declares that certain water rights are vested in the Crown [illegible] of the Province. Thus, section 2 states that :

"T[illegible] the use of all water at any time in any river, water-course, lake, or s[illegible] not being a navigable river or otherwise under the exclusive jurisdiction of the Parliament of Canada, is hereby declared to be vested in the Crown in the right of the Province, and, save in the exercise of any legal right existing at the time of such diversion or appropriation, no person shall divert or appropriate any water from any river, water-course, lake, or stream, excepting under the provisions of this Act, or of some other Act already or hereafter to be passed, or except in the exercise of the general right of all persons to use water for domestic and stock supply from any river, water-course, lake, or stream vested in the Crown, and to which there is access by a public road or reserve."

With respect to the obtaining of the exclusive right to the use of any water, the Act provides that such right shall not be acquired, or conferred, except by parliamentary enactment. Section 3 states :

"After the passing of this Act, no right to the permanent diversion or to the exclusive use of the water in any river, water-course, lake, or stream shall be acquired by any riparian owner, or by any other person, by length of use or otherwise than as the same may be acquired or conferred under the provisions of this Act, or of some existing or future Act of Parliament."

With respect to the powers and privileges that may be enjoyed by any Company, the Act, under section 4, states that :

"The powers mentioned in this section may also equally be granted to any person desiring to use or improve any water privilege of which he holds the record or to which he is entitled under any special Act of the Province."

Provision is also made for the publication of notice of application for water in the *British Columbia Gazette.*

The remaining portion deals more particularly with the rules and procedure of the Courts in connection with questions arising under the Act.

Chapter 115, 1897

In 1897, an important measure, chapter 115, was re-enacted, declaring that the Civil Laws of England, as the same existed on the nineteenth day of November, 1858, and in so far as the same were not, from local circumstances, inapplicable, should be enforced in all parts of British Columbia : provided, however, that the said laws should be held to be modified and altered by all legislation that still had the force of law of the Province of British Columbia, or of any former colony comprised within the geographic limits thereof.*

Water Clauses Consolidation Act, 1897

The Water Clauses Consolidation Act, 1897, is a highly commendable conservation enactment, and marks the greatest advance up to that time made in the water laws of the Province. The Act may be more fully described as one to confirm to the Crown all unrecorded and unappropriated water and water-power in the Province, and to consolidate and amend the laws relating to the acquiring of water rights and privileges for ordinary domestic, mining and agricultural purposes, and for making adequate provision for municipal water supply, and for the application of water-power to industrial and mechanical purposes. The Act also provides for the procedure by which the exercise of the provisions and powers set forth in the Act may be secured.

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*Under English Law the riparian owner has the right to the undiminished flow of a stream. Section 4 of the Water Act, 1914, relates to riparian rights. Since 1892, with practically no change, it has been preserved in the water legislation of the Province. The Water Act, 1914, section 6, provides for the clearing up of the situation in British Columbia with respect to riparian rights. It definitely states that, after June 1, 1916, riparian ownership, *per se*, confers no right to the use of water.

The question respecting whether a riparian owner under existing legislation in British Columbia, has any rights superior to, or over-riding, the rights granted by a provincial water record, was raised in the case of David Cook *vs.* City of Vancouver. Cook, a riparian owner, under a Crown land grant made 9th December, 1892, subsequent to the coming into force of Water Privileges Act, 1892, contended that he was being deprived of his riparian rights by the diversion of water by the City of Vancouver under a water record granted December 12th, 1905, by virtue of the Water Act of 1897. The Judgment of March 6, 1912, of the Supreme Court of British Columbia, and affirmed by the Court of Appeal of that Province, was that these riparian rights could not be upheld. (Consult *British Columbia Reports*, Vol. XVII, pp. 477 *et seq.*) The Judicial Committee of the Privy Council, on June 23, 1914, confirmed the decisions of the lower Courts. (See *Law Reports, Judicial Committee of the Privy Council*, 1914, pp. 1077, *et seq.*) The defendant's rights were *of record*, those of the riparian owner were not. Thus, since April 23, 1892, the riparian owner in British Columbia, has, in the opinion of the Court, not possessed the rights which riparian owners commonly enjoy under the law of England.

The preamble of the Act is an admirable recital of its general scope. It states that :

"Whereas, by the Water Privileges Act, 1892, all water and water-power in the Province, not under the exclusive jurisdiction of the Parliament of Canada, remaining unrecorded and unappropriated on the 23rd day of April, 1892, were declared to be vested in the Crown in right of the Province, and it was by the said Act enacted that no right to the permanent diversion or exclusive use of any water or water-power so vested in the Crown should after the said date be acquired or conferred save under privilege or power in that behalf granted or conferred by Act of the Legislative Assembly theretofore passed, or thereafter to be passed :

And whereas the Land Act, the Placer Mining Act, 1891, and the Mineral Act, 1896, contain provisions authorizing the diversion and use of water from natural water-courses and the acquisition of rights to the use of water upon the conditions as to such acquisition and diversion in the said Acts contained :

"And whereas it is necessary and expedient at the present session, to provide for the due conservation of all water and water-power so vested in the Crown as aforesaid, and to provide means whereby such water and water-power may be made available to the fullest possible extent in aid of the industrial development, and of the agricultural and mineral resources of the Province :

"And whereas for the furtherance of the purposes aforesaid, it is expedient to enact an exclusive and comprehensive law governing the granting of water-rights and privileges, and to provide and regulate the mode of acquisition and enjoyment of such privileges, and the royalties payable to the Crown in respect thereof :

"Therefore, Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows . ."

Clauses relating to water and of force in prior Acts, *viz.*, in the Mineral Act, 1896, chapter 34 ; the Placer Mining Act, 1891, chapter 26 ; The Placer Mining Amendment Act, 1894, chapter 33; the Land Act, 1888, chapter 66; the Land Act Amendment Act, 1891, chapter 15; the Water Viewers Act, 1888, chapter 117 ; and the Water Privileges Act, 1882, chapter 47, were repealed.

The Act, as printed in the Consolidated Statutes of 1897, consists of 154 sections. While it is impossible to review this important act in detail, attention must be directed to some of the new and important features which have been transmitted to the present Act. It provides that :

"Unrecorded water shall mean all water which, for the time being, is not held under and used in accordance with a record under this Act, or under the Acts repealed hereby, or under special grant by Public or Private Act, and shall include all water for the time being unappropriated or unoccupied, or not used for a beneficial purpose."

The rights of the Crown to all unrecorded water are most definitely affirmed, as may be seen from sections 4, 5, and 6, which state that :

"4. The right to the use of the unrecorded water at any time in any river, lake, or stream, is hereby declared to be vested in the Crown in the right of the Province, and, save in the exercise of any legal right existing at the time of such diversion or appropriation, no person shall divert or appropriate any water from any river, water-course, lake, or stream, excepting under the provisions of this Act, or of some other Act already or hereafter to be passed, or except in the exercise of the general right of all persons to use water for

domestic and stock supply from any river, lake, or stream vested in the Crown, and to which there is access by a public road or reserve.

"5. No right to the permanent diversion or to the exclusive use of the water in any river, lake or stream shall be acquired by any riparian owner, or by any other person, by length of use or otherwise, than as the same may be acquired or conferred under the provisions of this Act, or of some existing or future Act.

"6. The Lieutenant-Governor in Council may from time to time impose and reserve to the Crown, in right of the Province, such rents, royalties, tolls and charges in respect of the waters, or of the lands of the Crown and of the powers, rights and privileges, which may be acquired in pursuance of this Act, as by the Lieutenant-Governor in Council shall be deemed to be just and proper, and may likewise make and pass such regulations and rules as may be deemed necessary and advisable for the collection and enforcement of such rents, royalties, tolls and charges, or any of them :

"(a) Provided, that where by Order-in-Council such rents, royalties, tolls and charges are fixed in respect of any power, right or privilege, the same shall be permanent for the space of three years next succeeding the passing of such Order-in-Council fixing the same, and thereafter shall be subject to triennial adjustment, increase or decrease."

All considerations respecting the actual and beneficial use of water are again safeguarded. For example, section 7 states that :

"Every right, power, and privilege conferred by and acquired under this Act shall be subject to and conditional upon the reasonable use for the purposes for which such right, power, or privilege is conferred and acquired."

Every owner of land, *irrespective of whether he be a riparian owner or otherwise*, is given the right to secure a record and divert water for various purposes specified in the Act. Section 8 states :

"Every owner of land may secure the right to divert unrecorded water from any stream or lake for agricultural, domestic, or for mechanical or industrial purposes, and purposes incidental thereto, to an amount reasonably necessary therefore, upon obtaining a record thereof in manner hereinafter appointed."

This extension of right to 'every owner of land,' to secure a water record, naturally resulted in a large increase of records. The Act had provided that, unless construction work were started and diligently prosecuted to completion, the Commissioner might cancel the record. Thus, section 23 states :

"Within sixty days after the record is made, or within such further time as the Commissioner, or Gold Commissioner, may in his discretion, upon proof to his satisfaction of special circumstances rendering further time necessary, by writing duly recorded in the book of the record of water grants, the holder shall commence the excavation and construction of the ditch, flumes, and works in or by means of which he intends to divert, convey or utilize the water, and shall prosecute the work diligently and uninterruptedly to completion : Provided, always, that the Commissioner, or Gold Commissioner, may, in his discretion, allow such work to cease for any necessary or reasonable time, upon cause being shown. Upon the non-fulfilment of any of the conditions of this section, the Commissioner, or Gold Commissioner, may, upon notice, cancel the record."

The Commissioner, as in former acts, might also cancel a record for unreasonable use or wilful waste of water. The Commissioners, however, appear

seldom to have exercised this right, so that the records continued to accumulate, no matter how unreasonable may have been the circumstances under which some of them were held.

The Act of 1897 provided for the issuance, by the Lieutenant-Governor in Council, of a 'certificate of approval' of any proposed undertaking of a power company. The certificate was to fix the amount of the capital to be subscribed. It was to be certified under the hand of the Clerk of the Executive Council, and filed in the office of the Registrar of Joint Stock Companies. A copy of such certificate was to form part of the memorandum and articles of the association of the company. The certificate was to be published in the *British Columbia Gazette* and a copy filed in the office of the Commissioner. With respect to the carrying out of works of construction, it is specified in section 87, subsection 3, that

"Such certificate shall also fix the time within which the portion of the capital is to be subscribed in respect of the specified portion of such undertaking and works in such certificate dealt with, and the time within which such portion is to be commenced, and also the time within which such works shall be in operation: Provided that the aggregate of the times fixed for the subscribing of such amount of capital in respect of, and the commencing of, the first specified portion of the undertaking and works in such certificate dealt with shall not exceed twelve months, and in respect of the remaining portions of the undertaking and works shall not exceed such times as shall be prescribed by the Lieutenant-Governor in Council in that behalf."

And subsection 2 of section 90, respecting the first period of twelve months, states:

"The first aggregate period of twelve months hereinbefore provided in respect of the first specified portion of the undertaking and works shall not be extended under any circumstances, and no period of time fixed by any certificate granted to the power company shall be extended upon application made after such time has elapsed, except on condition that such extension shall be subject to any intervening record acquired, or any record thereafter acquired upon an application, notice whereof was given after the expiry of such time and before such extension."

The Act was not without its weaknesses. As was pointed out above, the failure to cancel records for adequate cause permitted troublesome documents to accumulate. If the proper executive agencies had been created, under this Act, so that the details of the new legislation could have been satisfactorily enforced, much that subsequently contributed to the complication of the water situation in British Columbia would have been avoided. Unfortunately, it was left for later legislation to create special boards of investigation and adjudication to deal radically with both old and new water records. Notwithstanding such weaknesses, the Water Act of 1897 was a measure of exceptional merit, and marked a great advance in water legislation.

Chapter 77, 1899

February 27, 1899, an Act to Amend the Water Clauses Consolidation Act, 1897, chap. 27, was passed, providing for alteration of the rates chargeable for rents, royalties, tolls and other charges in respect of the waters or of the land of the Crown; and of the powers, rights and privileges which may be acquired under said Act, by

the Lieutenant-Governor in Council. A special provision was also made for the purpose of declaring the rights of the West Kootenay Light & Power Co., Ltd., under part IV of the Water Clauses Consolidation Act, 1897.

Water Clauses Consolidation Amendment Act, Chap. 44, 1900

August 31, 1900, an Act to Amend the Water Clauses Consolidation Act, 1897, chap. 44, was passed. It provided for the acquisition of water for certain purposes by municipal Corporations, and was inserted after part IV of the Water Clauses Consolidation Act, 1897.

In general, chapter 44 provides that any municipal corporation may acquire the right to render water and water-power available for use, application, and distribution, by erecting dams, increasing the head of water in any existing body of water, or extending the area thereof, diverting the waters of any stream, pool, pond, or lake into any other channel or channels, laying or erecting any line of flume, pipes, or wire, constructing any raceway, reservoir, aqueduct, weir, wall, building, or other erection of work which may be acquired in connection with the improvement, and the use of said water and water-power, or by altering, renewing, extending, improving, repairing or maintaining any such works, or any parts thereof.

A Municipality may, subject to the conditions of the Act, also acquire or use the water or water-power for producing any form of power, or for producing and generating electricity for the purposes of any undertaking for which a by-law has been passed as aforesaid.

The Act requires that the municipality shall file, with the Clerk of the Executive Council, a complete statement of all facts and matters necessary to fully inform the Lieutenant-Governor in Council respecting the purposes and undertaking of the municipality, and all matters and things affected by, or relating thereto. The statement shall be accompanied by documents such as the special by-laws of the municipality which relate to the project, a certified statement from the Commissioner, respecting the existent records covering the waters to be used, a statement setting forth the character of the proposed works and undertaking, and an estimate of their cost.

The Act makes provision for the issuance, by the Lieutenant-Governor in Council to the municipality, of a 'certificate' approving the proposed undertaking and permitting the municipality to acquire, hold and exercise all the rights, powers, privileges and priorities mentioned and referred to in the certificate.

Wide powers are vested with the Lieutenant-Governor in Council, relating to the issuance of further certificates, the modifications of the terms of any certificates already issued, and for the imposing upon the municipality of such conditions as will protect the interests of persons whose lands or rights are affected by the undertaking of the works of the municipality.

Power Companies Relief Act, 1902, Chap. 56

The Water Clauses Consolidation Act, 1897, required that companies desiring to acquire and utilize water records would have to be incorporated under the provisions of such Act. This provision obviously necessitated the re-incorporation of many companies. To meet this difficulty, an Act to Enable Power Companies to Exercise the

Powers set out in Part IV of the Water Clauses Consolidation Act, 1897, Without Becoming Specially Incorporated (chap. 56) was passed on June 21, 1902. After reciting that it would be cumbersome to companies, already incorporated or licensed, to be compelled to reincorporate and maintain separate and distinct organizations, merely for the purpose of acquiring and maintaining water rights theretofore acquired, it states that :

"Any company heretofore or hereafter duly incorporated or licensed to carry on business in the Province of British Columbia, which company by its memorandum or Act of incorporation, is authorized to acquire, operate or carry on the business of a power company, may, notwithstanding the provisions of the Water Clauses Consolidation Act, 1897, relating to the incorporation of companies thereunder, acquire, hold, utilize and obtain the benefit of any water records lawfully acquired by the company by record, purchase or otherwise in the same manner, to the same extent, and with the same benefits and advantages to all intents and purposes as if the said company had been duly incorporated for any or all of such purposes under the provisions of the Water Clauses Consolidation Act 1897, and amending Acts. Provided, always, that any such company so incorporated, or licensed, shall in all other respects observe and perform the terms and conditions of the Water Clauses Consolidation Act, 1897, so far as applicable as fully and effectually as required by said Act.

"Before any company may obtain the benefit of the provisions of this Act, it shall pay to the Registrar of Joint Stock Companies the fees that must be paid by a company for special incorporation to exercise the powers set out in Part IV of the said Act, and the charges for publishing the certificate mentioned in this and the following section, and must obtain from said Registrar a certificate that the company has complied with the provisions of this Act, and is in the same position as if it had been specially incorporated as required by Part IV of the Water Clauses Consolidation Act, 1897.

"A copy of the certificate mentioned in the preceding section must be inserted in four successive issues of the *British Columbia Gazette*."

Chapter 72 of Acts of 1902, assented to June 21, 1902, is unimportant in the present survey, as it only refers to the amending of a single phrase relating to the acquisition by municipalities of water-works constructed by incorporated companies.

Water-courses Obstruction Act, 1903, Chap. 28

May 4, 1903, an Act, chapter 28, intituled the Water-courses Obstruction Act, 1903, was passed to prevent the obstruction of lakes and water-courses. It exempted any lawful works, such as dams, bridges, or the necessary felling of a tree to constitute a bridge from one side of a stream to another. Section 2 defines what are deemed to be unlawful obstructions. It states that :

"Subject to any jurisdiction of the Dominion of Canada in this behalf, and to any Acts passed in the exercise of such jurisdiction, in case a person throws, or in case an owner or occupier of a mill suffers or permits to be thrown, into any lake, river, stream, rivulet or water-course, slabs, bark, saw-dust, waste stuff or other refuse of any saw-mill, or stumps, roots, shrubs, tan-bark, driftwood or waste wood, or leached ashes, or in case a person fells, or causes to be felled, in or across such lake, river, stream, rivulet or water-course, timber or growing or standing trees, and allows the same to remain in or across such lake, river, stream, rivulet or water-course, he shall incur a penalty not exceeding ten dollars and not less than one dollar for each day during which the contravention of this Act continues, over and above all damages arising therefrom."

This Act was subsequently repealed incident to its provisions being incorporated in the Water Act.

February 10, 1904, 3 and 4 Ed. 7., Chapter 56, an Act to Amend the Water Clauses Consolidation Act, 1897, was passed. This measure is of little importance in connection with this survey. It relates to the diversion, for mining purposes, of certain specified quantities of water, having regard to records that may exist with respect to any particular stream.

Water Clauses Consolidation Act Amendment Act 1905, Chap. 55

Chapter 55, Water Clauses Consolidation Act Amendment Act, 1905, assented to April 8, makes provision for the correcting of water records. The applicant for a correction is required to give sixty days' notice in the *British Columbia Gazette*, and in a newspaper circulating in the District, and also ten days' notice to all record-holders and applicants for records for water upon the same stream or lake. Provision is also made for a hearing from objectors. The object of this Act is set forth in section 2, as follows :

"Water Clauses Consolidation Act, 1897, is hereby amended by adding thereto the following section :—

"Whenever a water record has been issued in the name of the wrong person, or contains any clerical error or wrong description of the water granted, or which the original applicant sought to have granted, of its point of diversion, place of user, or of the direction in which it is to be taken from point of diversion to point of user, the Commissioner of the district may, upon the application of the holder of such defective record, amend the said record, or may cancel the same and may grant a new one in its stead, which corrected record shall date back to the date of the one so amended or cancelled, and shall operate as if issued at the date of such cancelled record.

"The person intending to apply to have a water record corrected, under the provisions of this section, shall give sixty days' notice of his intention in the *British Columbia Gazette* and in a newspaper circulating in the district in which the record was granted, and shall give ten days' notice to all record-holders and applicants for records of water upon the same stream or lake, such notice to be personal, or where personal service cannot be made, then in manner directed by the Gold Commissioner.

"The Commissioner of the district shall hear all persons who object to the correction of the record, and from his decision, either for or against the applicant, there shall be an appeal.

"Sections 36 to 39, both inclusive, of this Act shall apply to such appeals."

Chapter 47 of 1906, assented to March 12, 1906, amends section 41 of the Water Act, 1897, relating to the expropriation of recorded water by municipalities, by substituting for "to the extent deemed necessary by the municipality" the words "to the extent proved by the municipality to the satisfaction of the Lieutenant-Governor in Council to be necessary."

Water Clauses Consolidation Act, 1897, Amendment Act, 1907, Chapter 47

April 25, 1907, by Chapter 47, Water Clauses Consolidation Act, 1897, Amendment Act, 1907, provision was made whereby an incorporated company, which had heretofore constructed and put in operation a system of water-works without obtaining the necessary certificate, as provided for by the Water Clauses Consolidation Act, 1897, might receive same. A judge of the Supreme Court was

empowered, upon its appearing to his satisfaction that the company had complied with certain specified provisions of the Act, to grant the company a certificate in such form as he may deem proper. Provision was made, also, for the holding of hearings, and the judge was empowered, if he deemed it necessary in the public interest, to insert in the certificate such conditions and restrictions, including restrictions applicable to the maximum rates to be charged by the company, according to his discretion.

Prior to 1909, a commission was appointed to enquire into all matters relating to the use of waters in the province. This commission subsequently published a report which largely prompted the preparation and enactment of the Water Act, 1909.

Water Clauses Consolidation Act, 1897, Amendment Act, 1908, Chap. 56

The Water Clauses Consolidation Act, 1897, was again amended March 7, 1908, by chapter 56, 1908. This amendment alters the procedure by an applicant for a water record. It specifies in greater detail where notices of application for a record are to be exhibited, and also, as in the Act of 1897, sets forth the particulars which the notice must contain. Further provisions are made with respect to the storage of water, and for the expropriation of lands required for same.

This amending act, with respect to power companies, provides in section 8, that:

"The power company shall, before proceeding with the construction of its works, apply to the Lieutenant-Governor in Council for approval and shall obtain a certificate of approval of its undertaking, and shall give notice of such intention by a notice inserted at the expense of the power company in the *British Columbia Gazette* and in any newspaper published and circulating in the district in which the works are to be constructed."

The various documents which the power company was required to file with the Clerk of the Executive Council, are the same as enumerated in the 1897 Act.

Water Act, 1909

Special attention has already been drawn to the great advance in water legislation represented in the Water Clauses Consolidation Act of 1897. We come now to the Water Act of 1909, which constitutes the next great effort to consolidate the experience gained in the operation of prior enactments.

In the administration of the very commendable Act of 1897, a number of difficulties were encountered which showed the necessity for modifying portions of it and for enlarging its scope. The framing of the new Act was entrusted to the Provincial Commissioner of Lands, Hon. F. J. Fulton. He personally, with expert assistants, made an investigation of conditions throughout British Columbia, as well as in the United States. Mr. Fulton states that Mr. Charles Wilson, K.C., draughted the Act and spent considerable time in weighing it section by section with various experts.* The Act is divided into

* Respecting parliamentary discussion of the Water Act of 1909, see the *Colonist*, Victoria, B.C., February 16th, 1909; for debate on second reading, by Mr. Fulton, see issue of February 16th, 1909, and *re* action by Committee of the Whole, see issues of March 2nd to March 12th, 1909; consult, also, *Index to the Journals of the Legislature*. Also, statement by Mr. Fulton before Western Canada Irrigation Association, published in *Report of the Proceedings of the Fourth Annual Convention*, held at Kamloops, B.C., August 3-5, 1910, pp. 25 *et seq*, Ottawa, 1911.

17 parts, each dealing comprehensively with a specific subject. As the Premier of British Columbia, when referring to this Act, with its 333 sections, stated, "It is not an Act that can be taken up and read and understood at first glance." It is, however, essential to our purpose that the bearing of some of the features introduced into this new measure be thoroughly appreciated. The preamble to the Act well sets forth its general object when it recites that :

"Whereas, all water in the Province, not under the exclusive jurisdiction of the Parliament of Canada remaining unrecorded and unappropriated on the 23rd day of April, 1892, has already been declared by the Legislature of the Province of British Columbia to be vested in the Crown in the right of the Province ;

"And, whereas, in the past, records of the right to divert and use water have been honestly but imperfectly made, resulting in confusion and litigation ;

"And, whereas, it is desirable that the rights of existing users under former records should be properly declared ;

"And, whereas, it is desirable and expedient that the law relating to the acquisition and use of water for all purposes should be amended and consolidated, and the right to acquire and use water be brought under one uniform system. Therefore, His Majesty, etc."

The Act devotes special attention to the interpretation of terms bearing special significance, such, for example, as 'water,' 'unrecorded water,' 'duty of water,' 'acre-foot,' 'record,' 'license,' etc. The Act states that 'record' shall mean an entry in some official book kept for that purpose, or any certificate of the record of water issued under the provisions of any Act of this Province ; and 'license' shall mean a license to use water, or take and use water. No license could be issued for more than one purpose. The definition of 'unrecorded water' in section 2, being the Interpretation Section, is important. It states :

"'Unrecorded water' shall mean all water which, for the time being, is not held under and used in accordance with a license under this Act, or a record under any former Act, or under special grant by public or private Act, and shall include all water for the time being unappropriated or unoccupied and not used for a beneficial purpose."

The Act strongly reaffirms the rights of the Crown in all unrecorded and all unappropriated water and water-power in the Province. There is some change in wording, as may be seen by comparing the new sections, 4 and 5, with those above quoted from the earlier legislation. Section 4 states :

"Saving the right of every riparian proprietor to the use of water for domestic purposes, the right to the use of the unrecorded water in any stream is hereby declared to be vested in the Crown in the right of the Province, and save in the exercise of any legal right existing at the time of such diversion or appropriation, no person shall divert or appropriate any water except under the provisions of this or some former Act, or except in the exercise of the general right of all persons to use for domestic purposes water to which there is lawful public or private access."

Section 5 states that :

"No right to the permanent diversion or to the exclusive use of any water shall be acquired by any riparian owner or by any other person by length of use or otherwise than as the same may have been acquired or conferred under this or some former Act."

A definite unit of measurement of water is introduced in section 6, which states that "The discharge of one cubic foot of water per second shall be the unit of measurement of flowing water, and the acre foot the unit of measurement of quantity."

The Chief Commissioner is authorized to divide the province, or such parts thereof as may be convenient, into districts, to be called 'Water Districts,' and to define the boundaries thereof.*

We have previously drawn attention to the fact that on many streams throughout the province the available water supply had been very much over-recorded. Frequently, there was only about one-fifth or one-tenth of the amount of water in a stream that would be required to supply the aggregate amount covered by the records, and, in some cases, the stream was over-recorded nearly twenty times. This condition of affairs was unendurable, and a Board of Investigation was appointed to deal with the problem in a manner in which it could not be dealt with under the Consolidated Act of 1897.

Board of Investigation, 1909

The Board of Investigation consists of the Chief Commissioner and two or more persons. According to section 9 of the Act, this tribunal is

". . . for the purpose of hearing the claims of all persons holding or claiming to hold records of water, or other water rights under any former public Act or Ordinance, of determining the priorities of the respective claimants, of prescribing the terms (not inconsistent with this Act) upon which new licenses to take and use water pursuant to this Act will be granted, and generally of determining all other matters and things in this part referred to the Board for determination, and discharging such duties with respect to existing rights and claims as may be imposed upon the Board, and with such powers and authorities for that purpose as are in this part conferred."

The Board was given wide powers to examine into the old *records*, make physical measurements of the flow of water, areas and respective character of lands involved, hold meetings, hear testimony, and, in fact, acquaint itself with all data essential to reaching the best possible decision in respect to clearing up the old records. It is obvious that, having all essential data before it, including information respecting the amount of water available from the stream or lake in question, knowledge of the quantity of land that can be brought under irrigation, information respecting previous records applicable to the source of supply in question, and, having also called before it all interested persons who wish to be heard, the Board would be in a satisfactory position to deal with and adjudicate upon the outstanding claims. Old records were to be reinstated according to their order of priority for such amount of water to each record holder as, in the opinion of the Board, he was entitled to.

By this procedure the old records were fairly dealt with, and superseded by granting to interested parties *licenses* authorizing the use of the water in question. Section 4 of the Act provides that every license shall have respect

* Respecting the establishing of Water Districts—see *British Columbia Gazette*, 1909, p. 1,062. Compare section 52, chapter 81, Water Act, 1914. On 24th July, 1913, by Order-in-Council, No. 1,031, the Water District boundaries formerly existing, which conformed to the boundaries of the Land Districts, were cancelled as from September, 1913, and were re-defined so as to conform to the confines of natural watersheds (see *B.C. Gazette*, July 31, 1913, p. 6,476).

to the requirements of riparian proprietors for domestic use, and section 49 defines the priority of purpose and of right in the acquisition of water, stating the various uses as follows :

"First—Domestic purposes ;

"Second—Municipal purposes, which shall mean and include the supply of water by any company to city, town, village, or unincorporated locality for domestic purposes ;

"Third—Irrigation of land for agricultural or horticultural purposes ;

"Fourth—Steam, which shall mean and include water required for the production of steam for working railways, steam factories, and all other purposes save the production of electricity ;

"Fifth—Power, which shall include the use of water for any other purpose excepting mining ;

"Sixth—Mining, which shall include the use of water for any purpose in connection with mining ;

"Seventh—Clearing streams for driving logs."

The Water Act of 1897, sec. 18, made a distinction between records obtained under that Act and any subsequent Act, and records under any Act 'heretofore passed,' that is to say, passed prior to May 8, 1897.

The subject of validity of early records in the case of non-users, under the 1909 Act, is open to the same kind of questioning that exists in the case of the 1897 Act, under section 4, construed in conjunction with the definition of 'unrecorded water' in the Interpretation Section. The framers of the 1909 Act deemed it expedient to leave decisions respecting the subject of validity in abeyance until such time as additional light could be thrown upon it by experience gained in the practical adjudication of the new Act or subsequent measures. Extensive provisions, however, are made under the 1909 Act for clearing up the early records.

Under the Act of 1897, if a water record had been abandoned, or was not in user, the Commissioner, upon the application of an owner of land who would be entitled to apply for a record of unrecorded water, could grant an interim record. But, the owner of the existing prior record, upon giving not less than three months' notice of his intention so to do, could exert the rights of his original record and thus nullify those of the interim record or at least such part thereof as he might reasonably require. The old records could not be cleared up by the Commissioner under the Act of 1897, and, unless invalid, such records might, as just intimated, lie dormant for many years and subsequently be brought to life by the original holder again exerting his prerogatives. This was due to the fact that the Act of 1897 made no provision wherel old records could be cleared up, the various issues at stake being left to arrangement between the parties involved or to decisions of the court. The Water Act of 1909 takes into consideration the fact that the Board of Investigation might not consider that records granted prior to May 8, 1897, were invalid under section 4, and the definition of 'unrecorded water' in the Interpretation Section of the 1897 Act, by reason of non-user. It permits the issuance of a license to the original holder of the record, provided he puts in his ditch and works, and makes beneficial use of the water within one year. (See section

Plate 7

ICE RIVER GLACIER, TRIBUTARY TO HOMATHKO RIVER
The foot of this glacier is only between 300 and 400 feet above sea.

REVELSTOKE HYDRO-ELECTRIC DEVELOPMENT, ILLECILLEWAET RIVER
Showing in-take dam and wood stave pipelines. Canadian Pacific Ry. grade may be seen above.

43.) Also, in the 1909 Act, provision is made (see section 253) that if the powers granted by any license—and this includes licenses replacing old records—be not exercised for three successive years, then such license automatically lapses. The Commissioner, however, has power to reinstate the license, and even to give it its original priority, if the representations made to him in the premises appear just and reasonable.

Part V of the Act sets forth the procedure necessary to obtain water licenses and defines the general rights acquired by licensees. It also specifies the jurisdiction that will be exercised by individual Water Commissioners.

Respecting the subject of water storage, the legislation first introduced in 1908 has been modified and amplified. The Water Act of 1909 enters more fully into this subject and makes provision for the storing of water whereby the holder of a license to store—subject to limitations imposed by the Act—receives right and property in the water so stored.

Section 250 of the Act requires of every licensee that :

"Every license issued under this Act shall be for the beneficial use of the quantity of water permitted to be taken and used, and notwithstanding the quantity of water granted by any license, no licensee shall, to the prejudice of others, divert more water from any stream than can for the time being be by him beneficially used, and the exclusive right shall be limited to the quantity of water his works will carry."

As previously pointed out, under section 253, if a licensee does not carry out his obligations in good faith, then

"If the powers granted by any license shall not be exercised (in good faith and not colourably) for three successive years, they shall, *ipso facto* become null and void. The Water Commissioner may, however, upon application to him and upon notice to all persons likely to be affected by such renewal, reduce the quantity of water granted or grant the quantity originally permitted and renew the license, giving it the original or any priority he may deem just."

The powers of the Water Commissioners are defined in section 287. It is not necessary to go into further details respecting this Act, because our chief object is to set forth the salient features of legislation as, from time to time, they appear in the various enactments—all to the end of assisting in the interpretation of the latest form of the provincial Water Legislation, and which has aimed at incorporating all that was desirable from previous legislation and experience.

The foregoing indicates some of the defects of the earlier Consolidated Act of 1897, and shows the pressing need of providing legislation and executive machinery by which the old records could be cleaned up. It has been indicated how, by the Act of 1909, a Board of Investigation was appointed for this purpose, and the character of its duties has been noted, as well as some other special features which it is unnecessary to recapitulate.

On March 10, 1910, Chapter 52, the Water Act, 1909, Amendment Act, 1910, was passed, providing for certain verbal and other modifications affecting executive procedure.

On March 1, 1911, by chapter 59, further amendments relating to various procedure on the part of the Water Commissioners, to advertisements, to ex-

tension of time with respect to surveys, and of works, etc., were made. These are largely of a detailed character and do not involve any change in principle.

Revised Statutes Chap. 239 1911

The Water Act of 1909, together with amendments, was consolidated in Chapter 239 of the *Revised Statutes of British Columbia*, 1911. In the administration of the Water Act of 1909, licenses issued by some of the district Water Commissioners created difficulties of the very kind which the Board of Investigation was appointed to remove. It became clear, therefore, that uniformity in the issuance of licenses could only be secured by issuing them from a central office. Mr. J. F. Armstrong, whose long experience with the water legislation of the province has been so valuable in assisting to bring the administration of the provincial water resources to its present efficiency, has well summarized the chief of the necessary amendments to the Water Act of 1909. He states that it was found necessary to :

1. Simplify the notices which were to be posted and published ;

2. Give the applicant a short delay in which to file the information to which the public was entitled, and a longer delay in which to pay the fees and prove to the Department that the water could be beneficially used for the purpose stated ;

3. Set a fixed time within which plans of the works for the diversion, carriage, and storage of the water should be submitted to the public and to the Department, and a fixed time for the commencement and the completion of these works ;

4. Entrust to one official the issue of licenses and permits and the granting of the other water privileges ;

5. Enable the Executive to grant a certificate of the approval of its undertaking to a company or municipality before the plans of works had been completed ;

6. Entrust to the Comptroller of Water Rights the approval of the plans of the works to be constructed ;

7. Provide a summary procedure on complaints for illegal diversion of water and other offences by a licensee ;

8. Provide for the inspection of dams and other structures which are alleged to be dangerous.

Water Act Amendment Act, 1912, Chap. 49

Amendments covering the features just enumerated, as well as other details, were enacted on February 27, by the Water Act Amendment Act, 1912, being chapter 49. It is virtually an amendment to the Water Act, 1909, and amendments, as consolidated by chap. 239 of the Revised Statutes, 1911.

The words 'Comptroller of Water Rights' were substituted for 'Chief Water Commissioner.' The Comptroller of Water Rights was empowered to issue the licenses to replace the former records as directed by the Board of Investigation. Certain functions specified in the Act were to be discharged by an official known as the Water Recorder. The amendments are quite extensive, and practically involve the recasting of Part V, dealing with Procedure to obtain Water Licenses, and the general ri[illegible] acquired by licensees, and also

of Part VI, dealing with the Approval of the Undertaking of Municipalities and Companies.

Water Act Amendment Act, 1913, Chap. 82

The Board of Investigation found that various matters could not satisfactorily be disposed of without further legislation, consequently, on March 1, 1913, the Water Act Amendment Act, 1913, chap. 82, was passed. Ignoring details, this measure, broadly speaking, provides for greater directness and latitude with respect to certain procedure.

Certain powers, formerly exercised by the Lieutenant-Governor-in-Council, were transferred to the Minister of Lands. This change permitted matters of a purely departmental character to be dealt with by the Minister, thus relieving the Executive Council. The Minister of Lands, for example, was empowered to grant approval of an 'undertaking,'* although appeal from the decision of the Minister could be made to the Lieutenant-Governor in Council.

Under former legislation, the Comptroller of Water Rights presided at all meetings of the Board. By the 1913 Amendment, the Lieutenant-Governor in Council might appoint some person other than the Comptroller to act as Chairman. Subsequently, the Comptroller was constituted, by statute, an *ex-officio* member of the Board.

Functions formerly performed by the Water Recorder were transferred to the Engineer of the Water District, a qualified technical officer to be appointed by the Minister of Lands. The Government Agent usually acted as local Water Recorder and often was not qualified to gather such information as was required for the purposes of the Board. By gathering in a satisfactory manner, physical and other data relating to the water matters under consideration, district engineers greatly facilitated the work of the Comptroller of Water Rights and of the Board of Investigation.

With respect to the procedure of the Board, a number of detailed amendments were made, whereby its jurisdiction was enlarged, and means provided for more effectual adjudication. A number of special matters are provided for, such as those relating to the cancellation of records ; the filing of documents with the Board ; the question of prescriptive rights ; the readjustment of licenses, which may, inadvertently, have been issued in an incomplete, imperfect or irregular manner ; also questions relating to the forfeiture of records or licenses ; questions affecting priority and precedence ; storage ; publication of notices ; the hearing of objections ; advertising by applicants ; the carriage of waters in works already constructed ; the issuance of conditional licenses ; the imposing of rents, royalties, tolls and other charges ; and other details relating to administration.

Respecting the posting of notices, it had been found that a large amount of detailed information demanded under the Act from applicants, in the initial stages of the consideration of their application, was not really required until a later period ; consequently, the necessity for providing certain data was suspended, also requirements, with respect to publication of notices, were made

* Respecting 'undertaking,' see Chapter 49 of Acts of 1912, especially Sec. 3.

less onerous. When the application is for domestic purposes, for 500 gallons per day, or less ; or for mining purposes, for 8 cubic feet per second, or less, the Local Water Recorder, if satisfied that all parties interested have been notified, may authorize the applicant to dispense with the advertising.

To remove ambiguity regarding the relative priority to be given to applications and licenses, it stipulates that all applications for water

". . . shall have precedence according to the time of the filing in the office of the Water Recorder for the district of a copy of the notices posted on the ground, and the licenses and the privileges thereby granted shall have precedence and priority according to the data of the said filing of the said notice, unless the contrary is stated in the license."

Irrigation Communities

In a province like British Columbia, where some lands are much more advantageously situated than others, settlers in possession of land requiring irrigation sometimes find it difficult and expensive to obtain water from available sources. In such instances, the settler may find it quite impossible to provide the necessary works for conveying and distributing the water. Many a proposition too difficult for the individual settler proves comparatively easy when handled co-operatively. The Water Act of 1909, by sec. 63, provided that licensees might combine for the construction of such works, and, in 1911, amendments were passed authorizing the mingling of the waters so carried. The Hon. William R. Ross, Minister of Lands, appointed Mr. J. F. Armstrong, Chairman of the Board of Investigation ; Mr. H. W. Grunsky and Mr. A. P. Luxton, K.C., to draft legislation dealing with 'Irrigation Communities.' Meantime, however, a new section, Part XA, which deals with this subject, was incorporated in the Water Act Amendment Act, 1913. This section consolidates the legislation of 1909 and 1911, and also includes additional provisions. Mr. J. F. Armstrong, who was largely responsible for the amendments, states :

"These amendments enable parties using a system of works to form a partnership—called an 'irrigation community'—to maintain and, if necessary, to construct the main works, to appoint a manager, and to levy assessments for the expense incurred. This method of organization entails but little expense and is sufficient when all interested join in the partnership. Similar provisions for mining purposes have been in the Statutes of the Province for many years." (See Part VII, of the Gold Mining Ordinance, 1867).

Having further legislation in mind, he adds :

"It has been suggested that, where the majority of the water-users under an unorganized system are in favour of forming an irrigation community they should be allowed to levy assessments on all who use the joint works, even if such users have not joined the partnership. It is claimed that these recalcitrants are enjoying the fruit of their neighbours' labours without contributing to the cost. It is also suggested that the liability of each partner should be limited to an amount proportioned to his interest in the partnership. It has also been asked that licensees who divert water for domestic purposes be authorized to form a waterworks community. These different suggestions are worthy of consideration."

In discussing the new legislation relating to irrigation communities, Mr. Grunsky points out, that there are two main ways by which irrigation companies may carry out the principle that a water right be made appurtenant to the

land for which the license is issued, and upon which the water is used. One way is by the formation of companies, which are strictly carrying concerns, having existence separate and apart from the land companies, the carrying companies to be subjected to public regulation. The other course is, by the organization of companies that will, along with each parcel of land sold, dispose of a share in the property right of their distribution system—provision being made for payment in instalments extending over a term of years and at rates which will permit of a sufficiently liberal profit to the irrigation companies to furnish an inducement to them to enter this field of activity. Under this latter plan the purchasers of land eventually own and operate the irrigation system.

The organization recommended by the Water Rights Branch, namely, one which would sell the land and water system together to the settlers on fairly long term payments, was adopted and the new part, entitled 'Irrigation Companies,' was incorporated in the Water Act Amendment Act of 1913. Commenting upon the object of this legislation, Mr. Grunsky succinctly states that the aim "is to provide for the creation of one type of irrigation company, at least, that will be approved by the Government, that will be in harmony with the principles of existing legislation, and under which an opportunity may be afforded to capital to receive ample profits from its investment in this field of enterprise."

Irrespective of this new part, however, provisions are maintained in the Act defining the powers, privileges and obligations of existing irrigation companies, and for regulating agreements made and tolls charged by them.

Subsequently, largely as a result of more extended research by Mr. Grunsky, comprehensive legislation relating to irrigation communities was introduced in the Public Irrigation Corporation Bill. This is comprehensively set forth and discussed in Mr. Grunsky's *Report on the Public Irrigation Corporation Bill.* He states :

"The Bill, in brief makes possible the joint ownership and corporate control of irrigation enterprises by the landowners of any locality in the province where the lands can be irrigated advantageously from a common source or sources of supply and through a common system of works. This is accomplished through the medium of publicly owned corporations known as 'public irrigation corporations.'

"The organization of these corporations resembles very closely that of city and district municipalities. They are in reality municipalities dealing only with matters relating to water, including its supply, its carriage and distribution, and its conservation.

"Through their instrumentality, money may be borrowed upon debentures or otherwise and taxes may be imposed which become a first lien upon the lands within the corporate limits. It is contemplated that, by means of these institutions, water-users will be enabled to co-operate effectively and on a large scale in the solution of their water problems."

Had it not been for the European war, this public spirited measure would doubtless have been more adequately subjected to a test of practical experience. No doubt this opportunity will come in the future.

Rules, Regulations and Fees

The Water Rights Branch commenced an investigation respecting the waters of the Province with the object of having sufficient data available respecting the special and natural advantages appurtenant to each stream, so that the fees payable for the exercise of rights relating to the use of waters would, so far as possible, be in accordance with their respective advantages. This was a basic doctrine specially urged by the Commission of Conservation in its first report upon the *Water Powers of Canada*, where it states that :

"Knowledge of the physical circumstances intimately associated with water-powers is essential to an intelligent classification of them. It is as unreasonable not to differentiate between water-powers as it would be not to differentiate between timber tracts, mineral lands, or the items of any other natural resource varying in quantity, quality and situation."

As a result of research by Mr. William Young, Comptroller of Water Rights, made under the direction of Mr. H. W. Grunsky, assisted by Messrs. E. Davis, C. A. Pope, and other members of the staff of the Water Rights Branch, the Dept. of Lands of British Columbia, by its Proclamation, dated September 3, 1913, promulgated the Rules and Regulations and Schedule of fees.* But here, again, owing to the European war, it was not possible to undertake the extra work necessary to the adequate carrying out of the provisions of these new Rules. They contain a number of special features conceived along broad lines and are well worthy of being tried out.

British Columbia Water Act, 1914

As the reasons for the creation of the prominent statutory features of the Water Act, Chap. 81, March 4, 1914, have been traced step by step, it is not necessary to make an analysis of the various provisions. It co-ordinates and brings into one complete code all prior Acts governing the use of water in British Columbia—whether they relate to mining, irrigation, power, the clearing of streams for logging or other purposes, the carriage or storage of water, or to other uses. Furthermore, the foregoing review sets forth the radical means adopted to prevent speculation in water titles ; to secure the actual beneficial use of water, the building of proper and substantial structures, the clearing up of old records and the granting of licenses to those entitled to receive them ; to make provision for reasonable extension of time to those who failed to construct works ; to facilitate the combination of water users to make supplies of water available for use by means not within the reach of an individual user ; in fact, it sets forth how the Government has sought, by numerous and diverse means, to conserve and make available, for beneficial use and in the public interest, the extensive water resources of British Columbia.

The Water Act of 1914 is an extensive measure of 172 pages and consists of 302 main sections. It presents in an orderly manner a comprehensive code dealing with the ownership and beneficial use of water.

* See *British Columbia Gazette*, February 12, 1914, p. 1,037, *et seq.;* also, see, *infra*, in this report where the rules are discussed, more particularly in their bearing upon the subject of fees and rentals respecting water-power. In the *British Columbia Gazette*, the rules are headed by the date 'September 3, 1913,' but this date has no significance, especially in view of the date 13th January, 1914, being specified in section 68 of the Water Act.

Any person who has intelligently perused the historical survey here presented cannot fail to possess a good understanding of this new Water Act, because essentially it is a consolidation of the previous Acts. There are certain revisions and additions, but these involve no departure from principle. The most extensive addition is Part VII, which relates to the creation and operation of companies or associations for the storage or distribution of water, and is an elaboration of the legislation to which special reference has already been made in the discussion relating to mutual water communities.

The subject of procedure has been more specifically set forth. The water rights of riparian owners have been dealt with by placing a time limit, within which all claimants to the use of water, by virtue of riparian ownership, must file their claims with the Board of Investigation. When the time limit expires, no further claims, based solely upon the ground of riparian ownership, will be recognized. (See sections 5 and 6.)

Special provisions are inserted to safeguard the granting of the more important and valuable water privileges, particularly those which involve the sale, barter, or exchange of water, or water-power. Referring to some of these features of the Act of 1914, the Hon. W. R. Ross, Minister of Lands, stated :

"Applicants for this class of privileges must not only obtain a water license from the Comptroller, but must have their undertakings approved by the ministry ; in fact this approval is one of the very first steps required of such applicants. In order to relieve the Minister of much detail work in this connection, the petition for the approval of the undertaking is, in the first instance, referred to the Board of Investigation, which makes its report to the Minister. The Board goes carefully into such questions as whether the financial position of the applicant gives promise of his carrying out the undertaking successfully, and as to whether the general scheme proposed is in the public interest. Applicants are not authorized to undertake surveys and the preparation of detail plans until they have obtained this approval of the undertaking as a preliminary step. In this way the plea that a particular applicant is entitled to consideration on the ground of having expended large sums of money is avoided."

Respecting the aims of certain measures for conserving the valuable water resources of the province, he added :

"Licenses issued to companies for water-works and power purposes are now being limited to a term of years, the maximum life of any such license being fifty years. In other words, such privileges are leased rather than given in perpetuity. A bond is required of applicants for these privileges to insure construction of works without undue delay. A rental fee is also charged during the survey-construction period, which is sufficiently onerous to discourage the mere holding of sites for speculative purposes. In order not to work an injustice on applicants who proceed with the construction of their works in good faith, all amounts paid for rental during the survey-construction period are, however, credited on account of rentals during operation period. This idea had been taken from the regulations of the United States Department of the Interior, and has the wholesome effect of making the applicant toe the mark in the survey-construction period, but lightening his burden in the early years of the operation period."*

*See paper by Hon. W. R. Ross, "British Columbia Irrigation Policies," in *Proceedings of the Twenty-first International Irrigation Congress*, held at Calgary, Alta, Oct. 5-9, 1914, Ottawa, 1915.

Under this system of limiting water privileges to a term of years, these assets will, automatically, lapse again into the hands of the province,—thus affording the opportunity for reconsidering terms in the light of conditions then existing. (See section 10.)

Water Reserves

Authority is conferred to create reserves of unrecorded water or to cancel same by Order-in-Council. Cancellation of a reserve, however, cannot become effective until the notice shall have been published for three months in the *British Columbia Gazette*, and in a newspaper. (See section 59.)

Water-Rights Maps

Under section 60, the Minister "may cause to be prepared in and for each water district, or any portion or portions thereof, a water-rights map, which shall show the location, points of diversion, conduits, places of user, and such works, references to records or licenses, and other particulars relating to the water in such district or portion of a district as the Minister may deem advisable." Also, "the Comptroller, as soon as a water-rights map in any locality is prepared, shall give every stream therein described, whether named or not and whether known by one or more names, an official name, having regard to the name of such stream on any existing official map ; and shall promptly report such name to the Chief Geographer of the Surveyor-General's Department, and such stream shall thereafter be known by such official name and no other, and shall be so described and known in all official maps, plans and documents."

With its 172 pages, the Water Act of 1914 is rather a formidable document. Technicalities need not be discussed, inasmuch as the average individual, whose interests fall within its jurisdiction, is not so much concerned with its more technical and legal aspects, as with those practical issues which govern his procedure in obtaining a license and which require him to use the waters beneficially, to construct works, and also to avoid such action, or non-action, as involve penalties. Hence, a condensed summary of such portions of the Act will be of great practical instruction and assistance to the average individual. Citation is given to the respective sections where the matters referred to are to be found, but the Act itself should be consulted in all matters of issue. Copies of the Act may be had on application to the Comptroller of Water Rights, Victoria, B.C.

The Water Act, 1914, is divided into nine main parts as follows :

Part	*Division of Act*	*Section*
I.	—Definitions and Interpretation of Terms	3
II.	—Ownership of Water and Water Privileges	4–20
III.	—Rights and Obligations of Licensees	21–51
IV.	—Organization and Administration	52–68
V.	—Procedure to Acquire a Water License	69–118
VI.	—Special Rights and Obligations of Particular Classes of Licensees	119–159
	Division 1.—Storage	119–124
	Division 2.—Irrigation	125–128
	Division 3.—Mining	129–130
	Division 4.—Water-works	131–132

One part of the Act outlines rights, obligations and procedure which are common to all water users. Then follow special divisions, setting forth specifically the rights and obligations of particular classes of licensees.

Organization and Administration

The Act devotes great attention to the subject of organization and administration. The Minister is empowered to divide the Province, or portions thereof, into districts, to be called

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* 'Class A,' in reference to any application or license, means any application or license for 'domestic,' 'mineral-trading,' or 'steam-purpose'; or for 'mining' or 'miscellaneous purpose,' where the water is to be used in quantities not exceeding 100,000 gallons per day; or for 'irrigation purpose,' where the acreage to be irrigated does not exceed 640 acres; or for 'power purpose,' where the power to be developed does not exceed 100 horse-power and is to be used by the applicant only: Provided, that, if in the opinion of the Comptroller, the nature of the works intended is such as to require the submission of detail plans, he may place any application which might come within the foregoing classification into 'Class B,' notwithstanding the foregoing limitations. (Water Act, 1914, section 3.)

'Class B,' in reference to any application or license, means any application or license for 'mining' or 'miscellaneous purpose,' where the water is to be used in quantities exceeding 100,000 gallons per day; for 'irrigation purpose,' where the acreage to be irrigated exceeds 640 acres; or for 'storage,' or 'hydraulicking' or 'fluming purpose,' where the water is to be used by the applicant only; or for 'power purpose,' where the power to be developed exceeds 100 horse-power and is to be used by the applicant only; or for 'lowering-water purpose': Provided, that if, in the opinion of the Comptroller, the nature of the works is such as not to require the submission of detail plans, he may place an application or license which might come within the above classification into 'Class A,' notwithstanding the foregoing limitations. (Water Act, 1914, section 3.)

'Class C,' in reference to any application or license, means a license by virtue of which water is held in gross, whether by special statute or otherwise; or an application or license for 'power,' 'hydraulicking,' 'clearing-streams,' or 'fluming purposes,' where tolls are to be charged; or for 'water-works' or 'conveying purpose.' (Water Act, 1914, Amendment Act, 1917.)

For convenience these definitions may be epitomized as follows:

Class A—
- *Domestic*—all
- *Mineral trading*—all
- *Steam*—all
- *Mining or Miscellaneous*—if not over 100,000 gallons per day
- *Irrigation*—if not over 640 acres
- *Power*—if not over 100 h.p. development, and for use of applicant only.

Class B—
- *Mining or Miscellaneous*—if over 100,000 gallons per day
- *Irrigation*—if over 640 acres
- *Power*—if over 100 h.p. development and for use of applicant only
- *Storage, Hydraulicking, or Fluming*—if for use by applicant only
- *Lowering-water*—all.

Class C—
- *Water held in gross*—all
- *Power, Hydraulicking, Clearing-streams, or Fluming*—if tolls are to be collected
- *Waterworks*—all
- *Conveying*—all.

'Water Districts,' and to define the boundaries thereof (section 52).* The Lieutenant-Governor in Council may appoint a Comptroller of Water Rights, the members of the Board of Investigation, Engineers and Water Recorders, for the various Water Districts, and such other officers and persons as may be necessary, who shall, respectively, have the powers and perform the duties given to them by the Water Act, or by the 'Rules.' The Minister of Lands shall authorize some member of the Board to act as Chairman. The Comptroller, in addition to the power specially given him, has all the powers and authority given Water Recorders and Engineers, and is also an *ex-officio* member of the Board, possessing the powers of a member thereof for all purposes, except in the determination of records and licenses made or issued under former Acts. (Section 53.)

The Engineer of a Water District is given extensive authority in connection with the direction and control of the diversion, storage and distribution of water, and is vested with wide powers of inspection and other duties under the Act and the 'Rules.' For example, when receiving complaints, summoning witnesses and hearing objections, the Engineer exercises the powers of a justice of the peace under the Summary Convictions Act. He may also, notwithstanding the construction of works, in accordance with approved plans, order any repairs, alterations and improvements in such works which may be necessary to prevent any extraordinary seepage loss. He is empowered to compel water users to construct substantial head-gates and to compel proper rotation in the use of water by irrigation licensees. Where licensees cannot agree respecting the distribution of water from any stream, as a last resort, a Water Bailiff may be appointed to act under the direct supervision and in accordance with the instructions of the Engineer. (Respecting powers and duties of Engineers, see sections 33, 34, 53 to 55, 57, 61 to 65; also 119 to 128, 143 and 292.) The 'Rules' referred to are, until amended or repealed, the rules under the Water Act as passed by the Lieutenant-Governor in Council on January 13, 1914. Procedure on the part of Engineers and other officers is clearly set forth, great pains being taken with the details of procedure in order to insure just and uniform dealing with the intricate matters comprised within the scope of the Act.

Necessity for Record or License

The necessity for acquiring a record or license is most definitely affirmed. The Act, by section 5, states that "no right to the permanent diversion or to the exclusive use of any water shall be acquired by any riparian owner or by any other person by length of use or otherwise than as the same may have been acquired or conferred under some former Act, or by license under this Act."

Beneficial Use

With respect to the subject of beneficial use, it is unnecessary again to discuss this basic doctrine. It may be said to permeate the whole Act. It is most clearly maintained that every license issued under the Water Act shall be for the actual beneficial use of the quantity of water permitted to be taken and used. If the water is not used

* Compare sec. 7, chap. 48, Water Act, 1909.

or is wasted, every licensee thus transgressing shall be subject to cancellation of his license, and, further, notwithstanding the quantity of water granted by his license, no licensee shall, to the prejudice of others, divert more water from any stream than can for the time being be, by him, beneficially used.

Measuring devices must be installed :

"Every 'Class C' applicant or licensee, from and after the time of receiving its authorization to make surveys, shall install and maintain in good operating condition, at such places and in such manner as shall be approved by the Comptroller, accurate meters, measuring-weirs, gauges, or other devices approved by the Comptroller and adequate for the determination of the amount of water used or electric energy generated (if any) in the operation of the works, and of the flow of the stream or streams from which the water is diverted or is to be diverted, and of the amounts of water held in and drawn from storage ; to keep accurate and sufficient records of the foregoing determinations to the satisfaction of the Comptroller ; and to make a return prior to the first day of March of each year, under oath, of such of the records of measurements for the year ending on December thirty-first preceding made by or in the possession of such person or licensee as may be required by the Comptroller." (See section 157.)

Procedure to Acquire Water License

The Act specifically describes the procedure by an applicant for a water license. The various steps are briefly summarized in the following table :

	Section
1. An applicant for a license to take and use water, shall first advertise his intention by posting notices of same, giving particulars specified in the Act	70
2. Copies of notices are to be filed in the Water Recorder's office and also served upon each owner whose land will be in any way affected by the proposed works	71
3. Advertisement must be made giving same particulars as are required for the notices of item 1, above. Advertisement is to be inserted : Once a week for four weeks in a local newspaper ; also in case of 'Class C' application, published for two weeks in the *British Columbia Gazette*	72
4. The applicant shall next file with the Water Recorder, his notice of application and sketch pursuant to his posted notice	73
5. The applicant must next submit to the Comptroller of Water Rights, full information as specified in the Act respecting the proposed undertaking	75
6. Payment of application fees must be made to the Comptroller. (Objections are here dealt with, if any are submitted, also, in the case of 'Class C' applications, the necessary steps are taken to secure the 'certificate of approval' from the Minister)	76–86
7. Provision is made whereby 'Class B' and 'Class C' applicants only must file plans and specifications of surveys relating to the proposed works and make further publication respecting filing of the plans, etc., after which the Comptroller may issue the *conditional license*	87–91
8. The next procedure is with respect to the taking and use of Crown or private lands for the carrying out of the proposed undertaking	92–116

9. The applicant next submits proof of the completion of the works and of the putting of the water to beneficial use, after which the *final license* issues for such part of the water applied for as has actually been put to beneficial use 117–118

Priorities The question of priorities is also dealt with in section 7, as follows :

"After the twelfth day of March, 1909, all applications for water shall be subject to the claims and rights as finally settled, and to the licenses issued by order of the Board under this Act ; and the said applications, and the licenses and privileges granted in pursuance thereof, shall, save as hereinafter specified, have relative precedence according to the time of filing in the office of the Water Recorder, as hereinafter provided, a copy of the notices posted on the ground.

"As between two or more pending and conflicting applications for the use of water from the same source, the Comptroller may take into consideration the various purposes for which the water is to be used under the respective applications, and may issue licenses with due regard to the particular purpose applied for, weighing one proposed use against the other ; and, if in his opinion the use proposed under an application of the later rank is of a higher standard and more in the public interest than the use proposed under an application of an earlier rank, he may issue licenses on the said applications and establish the rank of the said licenses irrespective of the rank of the applications. The following order and priority for the said purposes, with the definition of each thereof given in section 3, while not intended to interfere with the discretion given him under this proviso, is, in general, recommended for his consideration :

"First—Domestic purpose
"Second—Waterworks purpose
"Third—Mineral-trading purpose
"Fourth—Irrigation purpose
"Fifth—Mining purpose
"Sixth—Steam purpose
"Seventh—Fluming purpose
"Eighth—Hydraulicking purpose
"Ninth—Miscellaneous purpose
"Tenth—Power purpose
"Eleventh—Clearing-streams purpose
"Twelfth—Storage purpose
"Thirteenth—Conveying purpose
"Fourteenth—Lowering-water purpose."

Taking of Lands The Water Act makes extensive provision for the taking and use of either Crown or private lands which may be required for *bona fide* purposes by any applicant for a license. Such applicant, however, entering upon these lands shall first secure from the Minister of Lands, a permit to enter upon any lands of the Province, and shall also apply to the Minister of the Interior of Canada for the necessary permission where the lands are held in the right of the Dominion. In the case of private lands or occupied Crown lands, entry shall not be made upon such without first obtaining the consent of the owners. Procedure respecting absenteeism of owners, compensation, arbitration, action of the court, etc., is provided for. Every licensec is enjoined to do as little damage as possible

and full compensation must be paid to all owners for any loss, damage or injury incurred. (See sections 92-116.)

Wilful violation of any of the provisions of the Act may, in addition to penalties, involve the cancellation of the licensee's certificate or license ; and the diversion, wilfully, or without authority, of any water from any stream or works, or the diverting of a greater quantity of water than a person is entitled to, or the unlawful interference with the works of any licensee, and like action, are dealt with as serious offences. (See sections 18, 47, 48 and 62.)

Respecting the Termination of Water-power Leases

Water rights in British Columbia were, for the most part, taken out in connection with mining and agricultural development. It is, therefore, understandable how such rights were regarded as appurtenant to the hereditaments upon which the water was used. Thus, in effect, such rights were held as in perpetuity and, under the consolidating Act of 1911, chap. 239, forfeiture of rights could only result from non-use, abandonment or by cancellation for wasteful use or other default.

Now, although the 1914 Act, under sec. 10, requires in certain cases the stipulation of a definite license term, which in the case of licenses for water-power, municipal water supply or for the development of mineral springs, shall be limited to a period not exceeding 50 years, yet there is but little—either in the Act or in existing Regulations—to serve as a basis upon which, specifically, to re-consider at expiration, the terms of the original lease. Neither is there any definite setting forth of the measure of the authority which the Crown shall at that time exercise with respect to the existing works or other assets of those who, under license, have made the development in question. Other water legislation, less comprehensive, and where the doctrine of the right of the Crown is much less definite, has dealt more adequately with the subject of water-power leases.

Such questions, for example, as whether compensation shall be paid, and, if paid, for what classes of development ; what principles shall guide in the appraisement of values and what shall govern in arbitration proceedings or when arbitrators fail to agree ; how compensation shall be paid ; what conditions shall govern if works have to be taken over ; or shall lands with certain works thereupon revert to the Government without compensation. These and like problems require to be dealt with according to sound principles.

Doubtless, since the Province has seen fit to provide for such strict regulation respecting licenses granted to agriculturists and others whose development works are, individually, much smaller in extent and value than works necessary under "Class C," the authorities will not overlook the larger proposition to which reference is here made.

Safeguard in Order of Procedure

Provided the Board of Investigation, the Minister of Lands and the Comptroller, all act with foresight, good wisdom and accord, the interest of the Crown in connection with the granting of water-power or other important water rights, may in a measure be safe-

guarded—that is, to the extent of not permitting development except under conditions which will not prove a menace to the public welfare. The safeguard lies in the fact that, when an applicant for a water privilege to be used in connection with a public utility, makes his application for license, he must, concurrently, petition for a certificate approving the undertaking. The whole procedure must be well advertised and, before the application is granted, a public hearing, which is also well advertised, must be held (see secs. 71, 72 (2), 79). This hearing must be before the Board of Investigation (see sec. 80). The application goes to the Comptroller (see sec. 74). In the case of a 'Class C' license, the Comptroller must defer the issue of authorization to make surveys until a copy of the certificate of approval of the undertaking has been filed with him (see sec. 78). The petition goes before the Board of Investigation, which arranges for a public hearing and, afterwards, reports its recommendations thereon to the Minister (see sec. 80). The Minister may make an order in accordance with the recommendations of the Board, but it is reasonable to expect that, if the recommendations are wise and based upon proper evidence, his action will accord therewith. In a word, the safeguard in this general procedure is due to the fact that the application for the approval of the undertaking must be discussed in public and that the minister's approval must be obtained *before* the Comptroller can issue any authorization for the applicant to proceed with the next step to the obtaining of a license, namely, the making of detailed surveys (see secs. 78 (*e*) and 86).

Although these safeguards exist and, in a measure, tend to prevent the creating of troublesome developments, nevertheless, they do not provide the safeguards that would exist in the establishment by law of definite, broad and fair bases upon which re-consideration of relationships respecting terms, rentals, etc., between the Crown and lessee could be made at the termination of leases.

Capitalization of Perpetual Franchises

Referring especially to the subject of the possibility of water licenses becoming perpetual franchises and thereby permitting capitalization of same to be made upon such premises, greatly to the disadvantage of the public, Mr. O. C. Merrill, states :

"I believe that one of the most important features of a proper administration of water-power grants is the prevention of the capitalization of such grants. This can ordinarily be done only by limiting the duration of the franchise or grant. If, for example, a franchise is granted for forty years with the provision that, at the end of every ten years or every five years, the Province or its municipalities may purchase the property and works at an appraised valuation, the franchise, as such, ceases to have any value at the expiration of such periods, and the Province or its municipalities would pay for the property only, without any franchise value attached ; or, if the license is made indeterminate, as under the Wisconsin law—that is, if it runs indefinitely (not perpetually)—so long as the law and the conditions of the license are complied with and until the Province or some municipality elects to take over the property at an appraised valuation, the franchise value again automatically disappears with an offer on the part of the public to purchase, and the public

is not required to buy back from the company something which the same public originally gave to the company gratis."*

Water Act, 1914, Amendment Act, 1917

May 19, 1917, the Legislature of British Columbia assented to the Water Act, 1914, Amendment Act, 1917. It provides for a few modifications relating to procedure and other matters, but it chiefly sets forth in detail the functions to be exercised, and the procedure to be followed by the Lieutenant-Governor in Council, respecting a company authorized by memorandum of association, or by Act of the Legislature, to carry or supply, in the public interest, water for irrigation purposes. Wide powers are vested in the Lieutenant-Governor, amongst which is the power to :

"Declare, upon giving such notice as the Lieutenant-Governor in Council may see fit, that all reservoirs, dams, ditches, flumes, water systems, pipe-lines, works and all other structures of whatsoever kind used for storing or conveying water for the purpose of irrigating lands to which the water licenses in connection with which such works have been constructed are appurtenant, are and have been since the construction of the same, appurtenances of said lands, or, in the event of the company not having provided adequate means for conserving a sufficient water-supply to the whole of said lands, are and have been since the construction of the same, appurtenances of the lands of the individual owners as distinguished from the lands of the company." †

The section in the Water Act of 1914, which defines 'Class C' of water users, is amended and now reads as follows :

"'Class C,' in reference to any application or license, means a license by virtue of which water is held in gross, whether by special statute or otherwise ; or an application or license for 'power,' 'hydraulicking,' 'clearing-streams,' or 'fluming purposes' where tolls are to be charged ; or for 'water-works' or 'conveying purpose.'" ‡

The foregoing review of the water legislation enacted by the Province of British Columbia, itself, permits a better understanding of the concluding portion of this historical survey, which consists of a brief reference to the legislation of the Dominion of Canada affecting the waters of that portion of British Columbia—the Railway Belt—which is under the jurisdiction of the Federal Government.

Water Legislation Respecting the Railway Belt

July 20, 1871, British Columbia entered Confederation. The terms of Union are incorporated in the Schedule to the Imperial Order-in-Council of May 18, 1871, and are also included in addresses presented to Her Majesty the Queen from the Parliament of Canada, and from the Legislative Council

* See letter of O. C. Merrill, Chief Engineer, United States Forest Service, "Shall Water Licenses Be Perpetual ?" published in the *Report of the Minister of Lands for British Columbia* for 1912, pp. 125-126.

† Section 8, subsection (*a*), re-enacting Section 171 of Water Act, 1914.

‡ Compare Water Act, 1914, sec. 3. It may be explained that the phrase 'in gross' has been used in British Columbia to mean that the right to so much water could be acquired by a person or a corporation and treated as a personal right, without reference to the land upon which the water must be used or to the particular use to be made of the water.

of British Columbia, praying for the admission of British Columbia into the Dominion of Canada.*

Under article XI of the terms, Canada undertook to secure the construction of a railway extending from the Pacific seaboard through British Columbia, to connect with the railway system of Canada. In consideration of this, British Columbia agreed to "convey to the Dominion Government, in trust, to be appropriated in such manner as the Dominion Government may deem advisable in furtherance of the construction of the said railway, a similar extent of public lands along the line of railway throughout its entire length in British Columbia (not to exceed, however, twenty (20) miles on each side of said line), as may be appropriated for the same purpose by the Dominion Government from the public lands in the North-west Territories and the Province of Manitoba."

Railway Belt and Peace River Block Created

Pursuant to this undertaking there was set aside what is known as the 'Railway Belt' of British Columbia—a strip of territory forty miles wide and extending from the easterly boundary of the province at the summit of the Rocky mountains to a westerly limit bounded by the Meslilloet river, the North arm of Burrard inlet, and the western boundaries of townships 39, 38, 2 and 1, west of the Coast meridian.

The Provincial Government, by 43 Victoria, chap. 11, May 8, 1880, provided for the grant of the territory involved, but the actual conveyance was not made until the passing, by the Provincial Legislature, of an amending Act intituled An Act Relating to the Island Railway, the Graving Dock, and Railway Lands of the Province, being 47 Victoria, chap. 14, December 19, 1883.†

In addition to the land grant provided for and situate 20 miles either side of the railway line, there was, by the Act of the British Columbia Legislature of December 19, 1883, an additional grant made to the Dominion Government of "three and a half million acres of land in that portion of the Peace River district of British Columbia lying east of the Rocky mountains and adjoining the North-West Territory of Canada, to be located by the Dominion in one rectangular block." This is the tract known as the Peace River Block.‡

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* Consult provisions of section 146 of British North America Act, 1867; also, Pope, Joseph, *Confederation; Being a Series of Hitherto Unpublished Documents bearing on the British North America Act*, Toronto, 1895;—respecting British Columbia, consult Index *Ibid*; for copy of Order-in-Council, Schedule including Addresses, see *Revised Statutes of Canada*, 1906, Vol. IV, pp. 76-85. Consult, also, *Revised Statutes of British Columbia*, 1911, Vol. I, pp. XLIX, *et seq.* The Statute or Ordinance making change to constitution similar to that of Ontario is No. 147, in *Revised Laws of British Columbia*, 1871. For the present Constitution of British Columbia, see Chapter 44 of the Consolidated Acts, 1911. Consult *Documents Illustrative of the Canadian Constitution*, by William Houston, Toronto, 1891, see Note No. 30, pp. 233-34.

† This Act appears in the British Columbia Statutes for 1884, as chap. 14, December 19, 1883. It is usually cited as chap. 14 of 47 Victoria, 1884. As a matter of fact, however, it was passed in 46 Victoria, 1883. The Act, chap. 14 of 1883, assented to May 12, did not become operative and may here be neglected.

‡ This additional grant was made in lieu of such lands as had been alienated by British Columbia within the Railway Belt, prior to the passing of the Act of December 19, 1883, and was "to be taken by the Province in full of all claims up to this, the latter date aforementioned by the Province against the Dominion, in respect of delays in the commencement and construction of the Canadian Pacific Railway and in respect to the non-construction of the Esquimalt and Nanaimo railway, and shall be taken by the Dominion Government in satisfaction of all claims for additional lands under the terms of union."

PORTION OF THE INTERMONTANE VALLEY SHOWING BORDERING MOUNTAINS CRANBROOK TO WINDERMERE

Settlement and Jurisdiction

The Railway Belt land was conveyed by the Province to the Dominion, 'in trust' clearly with a view to its settlement at an early date.* Thus, section 11 of the Dominion Act, April 19, 1884, chap. 6, provides that :

"The lands granted to Her Majesty, represented by the Government of Canada, in pursuance of the eleventh section of the Terms of Union, by the Act of the Legislature of the Province of British Columbia, number eleven of one thousand eight hundred and eighty, intituled '*An Act to authorize the grant of certain public lands on the mainland of British Columbia to the Government of the Dominion of Canada for Canadian Pacific Railway purposes*,' as amended by the Act of the said Legislature, assented to on the nineteenth day of December, one thousand eight hundred and eighty-three, intituled, '*An Act relating to the Island Railway, the Graving Dock and Railway Lands of the Province*,' shall be placed upon the market at the earliest date possible, and shall be offered for sale on liberal terms to actual settlers."

Under section (*h*) of the recital of this Act the Dominion agreed that :

"The Government of Canada shall, with all convenient speed, offer for sale the lands within the Railway Belt upon the mainland, on liberal terms for actual settlers."

According to Court decision, the date of the transfer of the administration of the Railway Belt lands to, and the consequent assumption of jurisdiction by, the Dominion, was April 19, 1884, this being the date of ratification of the agreement by the Parliament of Canada.†

Province Contends for Waters

The Government of British Columbia contended that it had transferred only *the land* in the Railway Belt to the Dominion Government in trust for purposes incident to the construction of the railway, and that, in so doing, it had not relinquished its right to administer *the waters* of the Railway Belt. Accordingly, the Province continued to administer water and water rights within the Railway Belt just as it did those outside.

The settlers of British Columbia were accustomed to the operation of strict provincial water laws, and did not—unless in isolated instances—question this exercise of jurisdiction. In fact, the Railway Belt inhabitants continued to apply to the provincial agents for water rights. Only in exceptional cases, where parties had large interests and were more familiar with means of protecting such, were applications made to the Dominion authorities for grants confirmatory of those secured through provincial agency. In accordance with

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* Respecting the purpose and status of the Railway Belt lands, consult *Debate on the Subject of Confederation with Canada*, being *Reprint from the Government Gazette Extraordinary of March, 1870*, 165 pp., Victoria, B.C., 1912. Also, with respect to railway lands in British Columbia, including Order-in-Council of 16th May, 1871, and copies of many documents relating thereto, consult *Papers in Connection with the Construction of the Canadian Pacific Railway, between the Dominion, Imperial and Provincial Governments*, Victoria, 1880, pp. 139-310.

† Thus, Chief Justice Ritchie, in Queen *vs.* Farwell, Vol. 14, *Supreme Court of Canada Reports*, pp. 392 *et seq* (1887), has stated : "Therefore, so soon as the Act of the Dominion [47 Vict., chapter 6, 19th April, 1884], adopting and confirming the legislation of the Province [British Columbia Statutes, 1883, chapter 14, December 19, 1883] was passed, the line of the Canadian Pacific Railway thus selected by the Dominion Government and adopted by British Columbia, passed out of the control of the executive government of British Columbia, and was held by the Crown as represented by the Governor-General of Canada" (pp. 420-21). For confirmatory view, compare George *vs.* Mitchell, in *British Columbia Report*, Vol. 17, pp. 533 *et seq* (see p. 534).

the policy above mentioned, the Province, between 1884 and 1912, granted hundreds of water records in the Railway Belt, both with respect to Crown lands and private lands.

The provincial authorities felt strengthened in their contention by the following circumstances : The Dominion Government had not put into force special laws or regulations for the administration of the waters of the Railway Belt ; it had not attempted to exercise the jurisdiction which the Province felt was demanded by the circumstances ; they relied upon a decision given in what is commonly known as the Precious Metals case and to which passing reference must here be made.

Precious Metals Case

After 1884, specific questions arose, from time to time, respecting the extent to which the transference of the land to the Dominion carried with it the rights to minerals, waters, etc., and also respecting the jurisdiction of such natural assets.

On April 3, 1889, the case of the Attorney-General of British Columbia *vs.* Attorney-General of Canada—commonly known as the Precious Metals Case—was decided by the Judicial Committee of the Imperial Privy Council in favour of the Province.*

In the course of his judgment, Lord Watson stated :

"Leaving the precious metals out of view for the present, it seems clear that the only 'conveyance' contemplated was a transfer to the Dominion of the provincial right to manage and settle the lands, and to appropriate the revenues. It was neither intended that the lands shall be taken out of the Province, nor that the Dominion Government should occupy the position of a freeholder within the Province. The object of the Dominion Government was to recoup the cost of constructing the railway by selling the land to the settlers. Whenever the land is so disposed of, the interest of the Dominion comes to an end. The land then ceases to be public land, and reverts to the same position as if it had been settled by the Provincial Government in the ordinary course of its administration. That was apparently the consideration which led to the insertion, in the Agreement of 1883, of the condition that the Government of Canada should offer the land for sale, on liberal terms, with all convenient speed."†

It is manifest that this judgment, which seemed to uphold the contention of British Columbia, was, naturally, construed by the provincial authorities as confirmatory of the position they had taken with respect to waters in the Railway Belt. The Dominion authorities, however, questioned, from time to time, the course which the Provincial authorities were pursuing with respect to Railway Belt waters and water rights.

Burrard Power Case

Eventually the vexed question of water jurisdiction came into the courts. On April 7, 1906, the Provincial Water Commissioners for the District of New Westminster, purporting to act under the Water Clauses Consolidation Act, 1897, granted to the Burrard Power Company, at an annual rental of $566, a record for 25,000 inches of water out of Lillooet river and its tributaries. Lillooet river ‡ and

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* Consult, *Appeal Cases, Judicial Committee of Privy Council*, Vol. 14, pp. 295, *et seq.*
† *Ibid*, pp. 301-2.
‡ Now known as the Alouette river, see *Fifteenth Report of Geographic Board of Canada.*

Lillooet lakes lie within the limits of the Railway Belt. The water was to be diverted for power development and for industrial purposes, and, after use, was to be discharged into Kanaka creek, thus discharging by another route into the Fraser river.

Certain interests holding, from the Dominion Government, timber concessions on Lillooet lake, protested to the Department of the Interior that their rights would be injuriously affected by the proposed diversion. December 26, 1906, the Attorney-General of Canada fyled an information in the Exchequer Court of Canada. Subsequently, in the interest of the Province, the Attorney-General of British Columbia was made a party to this case, known as Burrard Power Company *vs* King. The plaintiff contended that, as the provincial grant of water to the power company was invalid and conveyed no interest to the company, the grant should be cancelled.

Decision re Burrard Power Case

May 10, 1909, the Exchequer Court of Canada gave decision in favour of the Dominion.* February 15, 1910, an appeal from this judgment was dismissed by the Supreme Court of Canada.† On appeal to the Privy Council, the Judicial Committee gave judgment, November 18, 1910, upholding the decision rendered in favour of the Dominion.‡

In delivering judgment for the Judicial Committee, Lord Mersey referred to the above quoted statement of Lord Watson with respect to the Precious Metals case. He pointed out that one of the objects of Article 11, of the Terms of Union, was to afford the Dominion a means of partially recouping itself for expenditures in connection with the construction of the Railway by sales to settlers of the land transferred. The Judicial Committee held that, "if the Province could, by legislation, take away the water from the land, it could also, by legislation, resume possession of the land itself, and thereby so derogate from its own grant as to utterly destroy it. Lord Watson's reference in the Precious Metals case, to the 11th Article, so far from supporting the appellants' contention, is against it. He says : 'The conveyance contemplated was a transfer to the Dominion of the provincial right to manage and settle the lands and to appropriate the revenues.' "

The Judgment of the Judicial Committee states :

"The grant of the water record in the case now under consideration is an attempt on the part of the Province to appropriate the revenues to itself, and would, if carried into effect, violate the terms of the contract as interpreted by Lord Watson. It is true that Lord Watson adds that the land is not by the transfer taken out of the Province, and that once it is 'settled' by the Dominion it ceases to be public land, and 'reverts to the same position as if it had been settled by the Provincial Government in the ordinary course of its administration.' But this also is against the appellants' contention, for it implies that, until settled by the Dominion, it remains public land under the Dominion's control.

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* Consult, Burrard Power Company *vs.* King, in *Exchequer Court Reports*, Vol. 12, pp. 295, *et seq.*

† Consult, *Supreme Court of Canada Reports*, Vol. 43, pp. 27 *et seq.*

‡ Consult, *Appeal Cases Before Judicial Committee of the Privy Council*, 1911, pp. 87 *et seq.* See also, *Canadian Digest*, Toronto, 1911, Vol. II, p. 4,097.

"Their Lordships are of opinion that the lands in question, so long as they remain unsettled, are 'public property' within the meaning of section 91 of the British North America Act, 1867, and, as such, are under the exclusive legislative authority of the Parliament of Canada by virtue of the Act of Parliament. Before the transfer they were public lands, the proprietary rights in which were held by the Crown in right of the Province. After the transfer they were still public lands, but the proprietary rights were held by the Crown in right of the Dominion, and for a public purpose, namely, the construction of the railway. This being so no Act of the Provincial Legislature could affect the waters upon the lands. Nor, in their Lordships' opinion, does the Water Clauses Act of 1897 purport or intend to affect them ; for, by clause 2, the Act expressly excludes from its operation waters under the exclusive jurisdiction of the Dominion Parliament."*

This judgment makes it clear that water records granted by the Province within the Railway Belt subsequent to the transference of the Railway Belt, really conferred no rights. On the contrary, the lands within the Railway Belt and all unalienated rights, including riparian and water rights connected therein, were subject to the jurisdiction of the Parliament of Canada.

Dominion Legislation following Burrard Decision

In anticipation of a favourable judgment, the Hon. Frank Oliver, Minister, Dept. of Interior, introduced during the session of 1909-10, Bill No. 187, being "An Act to Confirm and Declare the Right of the Crown for the Dominion, with Respect to Water and Water Power, and Relating to the Diversion, Acquisition and Use of Water in the Railway Belt, British Columbia." After receiving its first reading, March 23, 1910, the Bill was withdrawn. Later, subsequent to the Privy Council decision in the Burrard Power Case, Bill No. 124, being the Railway Belt Water Act, was introduced during the session of 1910-11. It provided means for adjusting conflicting claims and rights respecting the waters of the Railway Belt and for a system under which new rights should be granted. It received its first reading February 23, 1911, but never became law.† In 1911 the subject was again taken up.‡

Meantime matters connected with water rights within the Railway Belt were in a very unsettled state. The Provincial Water Act of 1909 was intended to apply to the waters of the whole Province, including those of the Railway Belt. This Act of 1909, with minor changes, was re-enacted in 1911. Thus, within the Province, as a whole, the Consolidated Water Act of 1911 was in force.

Railway Belt Water Act, 1912

April 1, 1912 the Dominion Parliament assented to the Railway Belt Water Act, 2 George V, chap. 47.** Sec. 5 states :

"The water so vested in and reserved to the Crown as aforesaid shall, during the pleasure of the Governor in Council, be administered under and in

* See *Appeal Cases, Ibid*, p. 95.

† This Bill is reprinted in *Water Powers of Canada*, 1911, pp. 314-16.

‡ For good *résumé* of Railway Belt Legislation, consult "*Water Rights in the British Columbia Railway Belt*," by H. W. Grunsky, being Part No. 12, included in *Annual Report of the Dominion Water Power Branch*, for year ending March 31, 1916, pp. 175-188, Ottawa, 1917 ; also, for corresponding material and for comprehensive description of the inauguration of the Railway Belt Hydrographic Survey, consult statement by P. A. Carson in *Railway Belt Hydrographic Survey for 1911-12*, being Dominion Water Power Branch, *Water Resources Paper No. 1*, pp. 17 *et seq.*

** This Act is reprinted in *Water Resources, Paper No. 1*, pp. 24-26.

accordance with the provisions of the 'Water Act, 1909,' of British Columbia, as if the said Act was enacted by the Parliament of Canada, and the officers and authorities having powers and duties to exercise and perform under the provisions of the said Act shall have the like power and authority with respect to or in connection with the administration of the said water."

Evidently, the Dominion, by this Act of 1912, intended to transfer to British Columbia the administration of the waters in the Railway Belt. Unfortunately, it specified the *Water Act of 1909*, which had already been superseded by the Provincial legislation of 1911. The Province, therefore, was placed in the position of having to apply one Act to the Railway Belt and another Act to the rest of the Province. Obviously, such anomalous administration was most unsatisfactory. Means were, therefore, sought by which to deal with the existing situation. Representations were made by the Minister of Lands of British Columbia, the Hon. W. R. Ross, demonstrating that, from the provincial standpoint, the existing legislation would prove ineffective and unsatisfactory. He requested that the Provincial authorities be fully empowered to deal with the many conflicting claims and interests which had arisen, due to conditions prevailing in the Railway Belt.

Referring to the existing dual administration, Hon. W. R. Ross stated :

"Think of what it would have meant to have a dual administration in the Belt. Innumerable streams in that section, whose waters are much in demand, flow, now on Provincial and now on Dominion lands. The situation is further complicated by the fact that, as fast as the Dominion Government issues patents to private lands, the lands so patented come under provincial jurisdiction. The boundary of the Belt, therefore, has been a constantly changing one as far as water adminstration is concerned, and many cases have arisen where the act of either the one Government or the other in granting certain rights in the waters has been called into question."*

Consequent upon the representations of the provincial authorities, the Minister of the Interior, Hon. W. J. Roche, introduced the Railway Belt Water Act, 1913. This Act, chap. [illegible] was assented to June 6, 1913. By section 5, amending secs. 3, 4, 5 and [illegible] 1912 Act, it specifically recognizes that:

"All records, grants, lic[illegible]ders in council, claims or contracts of, for affecting the use of water within the Railway Belt, heretofore granted or purporting or *bona fide* claimed to have been granted by any provincial or local authority and all applications to such authority for records, grants, licenses, orders in council, claims or contracts of, for or affecting the use of water within the Railway Belt heretofore made and now pending shall be deemed to be valid and effective to the same extent for the like purposes, and subject in the like manner to the jurisdiction of the Board, (and shall be subject to all the obligations and limitations imposed by the Water Acts), as if made, issued, authorized, claimed or pending with respect to water in British Columbia not within the Railway Belt."†

Provincial Administration Consummated

Thus, by this Act, the hundreds of invalid water records granted by the provincial authorities in the Railway Belt in the years 1884-1912, were validated, subject, however, to the preservation of the integrity of the grants made, in the same period, by the Dominion

* See *Daily Colonist*, Victoria, V.I., June 15, 1913.
† This Act is reprinted in *Water Resources, Paper No. 1*, pp. 26-28.

Government; and the Water Acts of British Columbia existing on June 6 1913, namely, the Consolidated Act of 1911, and the amendments of 1912 and 1913, were expressly made applicable to the administration of the Provincial authorities within the Railway Belt.*

By an alteration in the definition of the term "Railway Belt," an exception was made in the case of waters in all reserves or areas that were then, or in the future might be, set apart and designated as Dominion Parks. The waters in these reserves are now administered by the Dominion authorities under the Dominion Forest Reserves and Parks Act, and under water-power regulations of the Dominion Government applicable to Dominion lands in Manitoba, Saskatchewan, Alberta and the Northwest Territories.†

The Dominion Railway Belt Water Act, as amended in 1913, had provided for making the provincial Water Act of March 4, 1914—which consolidated and revised the water legislation of the Province—effective within the Railway Belt. Thus, the Dominion measure states:

"The Governor in Council may direct that any Act, or portion thereof, passed by the Legislature of the Province of British Columbia after the third day of March, nineteen hundred and thirteen, relating to water in the province not within the Railway Belt, shall apply to the water in the Railway Belt as if such Act were enacted by the Parliament of Canada.

"Every Order in Council passed under the authority of this section shall have force and effect only after it has been published for four consecutive weeks in *The Canada Gazette*. Every such Order in Council shall be laid before both Houses of Parliament within the first fifteen days of the session next after the date thereof, and such Order in Council shall remain in force until the day immediately succeeding the prorogation of that session of Parliament, and no longer, unless during that session it is approved by resolution of both Houses of Parliament."

February 27, 1915, the Dominion Government, by order in council,‡ made the provincial Water Act of 1914 effective—with the exception respecting Parks just explained—for administering Dominion waters within the Railway Belt.

* With regard to the views of the provincial authorities respecting the advantages accruing from the Dominion's action in vesting jurisdiction in the Province, consult comprehensive statement by Hon. W. R. Ross on 'Water Rights' in the *Daily Colonist*, Victoria, June 15, 1913. Also, for a statement made, following a conference subsequently held between officials from the Dept. of Interior and the Province, respecting the transference of executive papers relating to Dominion and Provincial administration of waters, the conducting of hydrographic surveys, etc., see 'Water Rights Now on Workable Basis,' in the *Daily Colonist*, Victoria, August 21, 1913.

† Water-powers in these provinces and territories are administered under section 35 of the Dominion Lands Act, 7-8 Edward VII, chapter 20, as amended by section 6, chapter 27, of 4-5 George V, and Regulations established and approved thereunder (in virtue of the provisions of subsection (*b*) of section 17 of the Dominion Forest Reserves and Parks Act, 1-2 George V, chapter 10). Orders-in-Council respecting the Regulations are dated June 2, 1909, June 8, 1909, April 20, 1910, January 24, 1911, June 6, 1911, August 12, 1911, August 2, 1913, February 9, 1915, and August 6, 1917. The Order-in-Council of June 6, 1911, made the Regulations applicable to all forest reserves and parks; the Order-in-Council of February 9, 1913, makes them applicable to all school lands; the Order-in-Council of August 2, 1913, facilitates the granting of leases and licenses in the case of small water-powers of less capacity than 200 horse-power, and the Order-in-Council of August 6, 1917, provides for the protection of lands necessary to water-power development, by stipulating that such lands shall only be conveyed to homesteaders as a leasehold tenancy from year to year. For copy of section 35 of Dominion Lands Act; also for copy of Water-Power Regulations, see *Water Powers of Manitoba, Saskatchewan and Alberta*, by L. G. Denis and J. B. Challies, pp. 302 *et seq.*, Commission of Conservation, Ottawa, 1916; also, *Water Powers of Manitoba*, by D. L. McLean, S. S. Scovil and J. T. Johnston, being *Water Resources Paper No. 7*, Chapter IX, pp. 209 *et seq.*, Dominion Water Power Branch, Ottawa, 1914.

‡ See *Canada Gazette*, March 6, 13, 20 or 27, 1915.

Dominion Retains Certain Control

Although the various difficulties relating to water administration have now been satisfactorily adjusted between the Dominion and Provincial authorities, and co-operative arrangements are now carried on with respect to surveys and other matters, yet the Dominion Government has not surrendered its basic jurisdiction over the waters in the Railway Belt. Instead, it has virtually made the provincial authorities trustees for the interests of the Dominion Govermnent in those waters and, under the existing legislation, retains the power to withdraw at any time the administration granted to the Province.

The Dominion Government, under the Railway Belt Act (chap. 59, R.S.C., 1906), and under such regulations as have been established by the Governor in Council in conformity with this Act ; also under section 9 of the Railway Belt Water Act as amended in 1913, specifically reserves all control over, and administration of, Dominion lands within the Railway Belt. This control constitutes an important check upon the provincial authorities, inasmuch as no important development of Railway Belt waters is possible without control or ownership of lands adjacent to the waters, and release of such lands would have to be obtained under conditions imposed, or approved, by the Federal authorities.* Thus the Act provides that

"The Governor in Council may, from time to time, regulate the manner in which and the terms and conditions on which the said lands shall be surveyed, laid out, administered, dealt with and disposed of."†

In accordance with arrangements made between the Federal and Provincial authorities, the following clauses are to be inserted, respectively, in every authorization and license issued, involving entry upon Crown lands that lie within the Railway Belt.‡

Each authorization involving entry upon Crown lands states :

"This authorization shall not be valid or effective to authorize the use or occupation of any lands belonging to the Crown in the right of Canada unless and until approved by the Minister of the Interior of Canada, and shall be subject to such terms and conditions as the said Minister may prescribe respecting such use or occupation."

Each license involving entry upon Crown lands states :

"This license shall not be valid or effective to authorize the construction or maintenance of any works upon or the use or occupation of any lands belonging to the Crown in the right of Canada unless and until approved by the Minister of the Interior of Canada, and shall be subject to such terms and

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* *Author's Note.*—While this Report was in the press the Federal authorities of Canada promulgated "Water-Lands Regulations," which contain special provisions for the disposal and administration of lands in the Railway Belt of British Columbia required for the development of water-powers and other water privileges. These regulations are intended to harmonize with the administration of waters by the provincial authorities. The Regulations were published in the *Canada Gazette*, July 20, 1918, pages 249 to 252 : also in issues of July 27, Aug. 3 and Aug. 10. Application, of course, may be made either to the Dominion or the Provincial authorities for copies of these Regulations.

† See sub-section 4 of section 11.

‡ Where Indian Reserve lands are involved, there would be substituted the proper terminology applicable to such lands as administered by the officers of the Department of Indian Affairs, Canada.

conditions as the said Minister may prescribe respecting such construction, maintenance, use or occupation "

Problems, both Provincial and Dominion, respecting the use of the inland waters of British Columbia, have now been reduced to a satisfactory working basis.

The foregoing historical survey, commencing with early colonial days, indicates how the present provincial water legislation has been evolved ; and it shows that there was little, either in the common law of England, or in the statutes of older commonwealths, which could adequately serve as a precedent for the solution of many of the problems peculiarly associated with the use of waters in British Columbia. The Province has seriously and diligently wrestled with its own water problems and has, step by step, developed its present comprehensive water code—a code which, under wise administration, cannot fail to promote the welfare of the citizens of British Columbia, and a code which will, under the Canadian form of government, undoubtedly stand the test, alike of time and of all litigation that may be brought against it.

Chronological Key to Water Legislation in British Columbia

The early Proclamations and Acts of Vancouver Island and British Columbia which embody clauses relating to water rights, contain, in addition, much matter which sometimes renders it difficult readily to detect those portions of legislation which bear specifically upon the use of water in the Province.

The following chronological list of enactments constitutes a guide to the various Proclamations and Acts and also to the particular places in such where references to water will be found.

The numbers of early Proclamations are those found in the copies of the early Proclamations and Acts as bound, indexed and filed in the office of the Attorney-General of British Columbia.* Wherever available, the *short titles* have been given. Such of the Statutes and earlier Proclamations, as are reproduced in *Martin's Mining Cases*,† have been indicated in the following list by the letter M.

Proclamations, Regulations and Acts

1858—Sept. 2, Revocation of License of May 30, 1838, to Hudson's Bay Company.

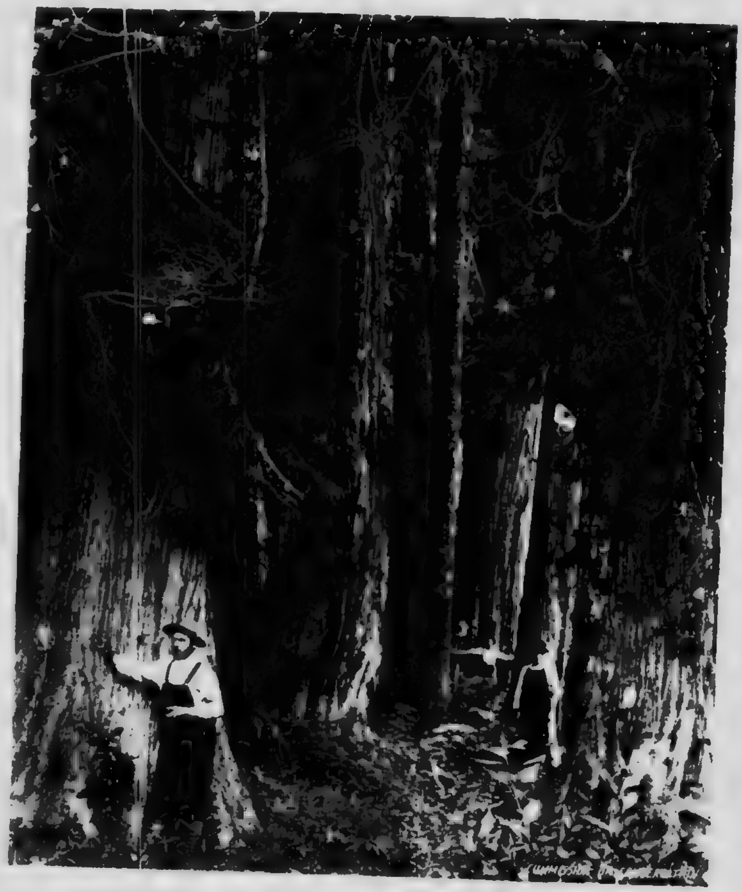
1858—Nov. 19, Imperial Act, 21-22 Vict., chap. 99, Aug. 2, 1858 ; An Act to Provide for the Government of British Columbia ; consult preamble, also section I, defining Boundaries, and section VI, which excludes Vancouver Island.

1859—Feb. 14, British Columbia Land Proclamation ; see sections 1, 3, 6, 8 and 9.

1859—Aug. 31, Gold Fields Act, 1859 ; consult 2nd paragraph, also sections VI, VIII, XI, XII and XVI—(M).

* See *Author's Note*, page 48.

† See *Reports of Mining Cases, Decided by the Courts of British Columbia, and the Courts of Appeal Therefrom*, etc., by Hon. Archer Martin, 2 vols., Toronto, Vol. I, 1903; Vol. II, Part 1, 1905; Part 2, 1908; Part 3, (in preparation); see especially in Vol. I, pp. 531 *et seq.*



Cedar Forest.

Fir Forest.

BRITISH COLUMBIA COAST TIMBER

The lower slopes and valleys of the Vancouver Island range, and of the western side of the Coast mountains are usually covered with a dense growth of heavy timber

1859—Sept. 7, Rules and Regulations for the Working of Gold Mines, see sections I, VII to XI, XIII, XVIII and XIX—(M).

1860—Jan. 4, British Columbia Land Proclamation, see sections 1 and 16.

1860—Jan. 6, Rules and Regulations for the Working of Gold Mines; consult preamble, also, section VI.

1861—Feb. 19, Proclamation No. XXVII, Vancouver Island Land Proclamation, 1861; see section XVIII, which relates to the saving of water privileges for mining purposes.

1861—Aug. 27, No. 9, British Columbia Pre-emption Consolidation Act, 1861; see section XXVII.

1862—Sept. 6, No. LIX, Vancouver Island Land Proclamation, 1862;* consult preamble, also, sections I and XXXIV.

1862—Sept. 29, No. 9, Rules and Regulations (Ditches) Under The Gold Fields Act, 1859; consult especially preamble, also, sections I and VIII to XII.

1863—Feb. 24, Rules and Regulations issued in conformity with Gold Fields Act, 1859; consult preamble, also sections IV, V and VIII.

1863—Mar. 25, No. 4, Gold Fields Act, 1863; consult preamble, also sections 3, 4, 5, 6 and 10.

1864—Feb. 1, No. 1, The Mining Drains Act, 1864; see sections I and IX.

1864—Feb. 26, No. 4, Gold Fields Act, 1864; consult sections 9 to 26 relating to Bed-rock Flumes, also sections 37 and 56.

1864—May 4, No. 13, The Inland Navigation Ordinance, 1864; consult sections XVI and XVII, which define inland waters.

1865—Mar. 28, No. 14, Gold Mining Ordinance, 1865; consult section 29, also Part V *re* Bed-rock Flumes, being sections 52-55; Part VI *re* Drainage, being sections 56 to 65 and Part X *re* Ditches, being sections 99-125.

1865—Apr. 11, No. 27, Land Ordinance, 1865; consult preamble, also sections 1, 2, 3, 8, and 24, and under 'Water,' sections 44 to 50.

1866—Mar. 29, No. 10, The Williams Creek Flume Ordinance, 1866; see preamble, also clauses (e) and (f) of section I.

1866—Nov. 19, Union of two Colonies of British Columbia and Vancouver Island.

1867—Mar. 6, The English Law Ordinance, 1867, An Ordinance to Assimilate the General Application of English Law; see section 2.

1867—Apr. 2, No. 34, Gold Mining Ordinance, 1867 (see section 36), also Part V. *re* Bed-rock Flumes, being sections 59-68; Part VI., *re* Drainage of Mines, being sections 69-77 and Part X, *re* Ditches, being sections 106-132—(M).

1870—June 1, No. 18, Land Ordinance, 1870; consult preamble, also section II and, under heading 'Water,' sections XXX to XXXVII.

1871—*Revised Laws of British Columbia*, 1871; No. 90 is the Gold Mining Ordinance 1867; No. 144 is the Land Ordinance, 1870 (see above).

1872—Apr. 11, No. 14, An Act to Amend The Gold Mining Ordinance, 1867; see section 10, which relates to periods of water scarcity.

1872—Apr. 11, No. 28, Public Works Act, 1872; (see sections 1, 2, 3, 4 and 6).

1872—Apr. 11, No. 31, Land Ordinance Amendment Act, 1872; consists of sections 1, 2, 3, 4, and deals with beneficial use of water respecting lands.

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* The water clause in the Vancouver Island Proclamation, No. LIX of 1862, follows very closely that of Proclamation No. XXVII of 1861.

1873—Feb. 21, No. 1, The Land Ordinance Amendment Act, 1873; see sections 7 and 19.

1873—Feb. 21, No. 9, Public Works Extension Act, 1873; see sections 6, 17, 19 and 20.

1873—Feb. 21, No. 10, The Drainage, Dyking and Irrigation Act, 1873.*

1873—Feb. 21, No. 4, The Gold Mining Amendment Act, 1873; see section 13 which relates to tunnels for draining purposes.

1874—Mar. 2, No. 2, Land Act, 1874; this is a consolidation of land laws, consult sections 1, 48 to 55, 74 and 81.

1874—Mar. 2, No. 24, Real Property Conveyance Act, 1874, being an Act to facilitate the conveyance of Real Property; see section 2.

1874—Mar. 2, No. 25, Leaseholds Act, 1874, being an Act to facilitate the granting of certain leases; see section 2.

1875—Apr. 22, No. 5, Land Act, 1875; consult section 1, 48 to 55, 74 and 81, which correspond in numbering and text to sections in the Land Act, 1874.

1876—May 19, No. 14, British Columbia Line Fences and Water Courses Act, 1876; see sections 3 and 6, which are typical.

1877—*Consolidated Statutes of British Columbia*, 1877; chapter 123 is the Gold Mining Ordinance, 1867 (consolidated with chapters 14 of 1872; 4 and 14 of 1873; 3 of 1874, and 26 of 1876); chapter 98 is the Land Act, 1875; chapter 75 is the Line Fences and Water-courses Act, 1876.

1882—Apr. 21, chap. 6, Land Amendment Act, 1882; see sections 3 and 4.

1882—Apr. 21, chap. 8, Mineral Act, 1882; consult sections 1, 2, 13, 49, also Part V, *re* Bed-rock Flumes, being sections 80-89; Part VI, *re* Drainage of Mines, being sections 90-99; and Part X, *re* Ditches, being sections 128-153.

1884—Feb. 18, chap. 10, The Mineral Act, 1884; consult sections 6 and 41, also Part V, *re* Bed-rock Flumes, being sections 75-84; Part VI, *re* Drainage of Mines, being 85-94; and Part X, *re* Ditches, being sections 123-149—(M).

1884—Feb. 18, chap. 16, Land Act, 1884; see sections 43 to 53 and 65.

1886—Apr. 6, chap. 10, An Act to Amend the Land Act, 1884; see sections 1, 2, 3, 4 and 5.

1886—Apr. 6, chap. 24, An Act Providing for the Election and Defining the Duties of Water Viewers.

1888—Apr. 28, chap. 16, An Act to Amend the Land Act, 1884; see section 1, which relates to the diversion of water to Indian Reserves.

1888—*Consolidated Statutes of British Columbia*, 1888; chapter 82 is the Mineral Act and *re* water embodies chapter 10 of 1884; chapter 66 is the Land Act, and *re* water (sections 39 to 52) comprises chapter 16, 1884, chapter 10, 1886, and chapter 16, 1888; chapter 117 is the Water Viewers Act, being chapter 24, 1886; chapter 36 is the Drainage, Dyking and Irrigation Act, 1873, as amended by chap. 9, 1881, and chap. 4, 1882.

1890—Apr. 26, chap. 39, British Columbia Railway Act; see sections 9(3) and 9(5).

1890—Apr. 26, chap. 43, Rivers and Streams Act, 1890; an act to regulate the clearing of rivers and streams; contains 17 sections.

* For further and later legislation respecting drainage and dyking, consult the ***Statutes of British Columbia.*** See, for example, chapter 69 of the Revised Statutes of 1911.

1891—Apr. 20, chap. 25, Mineral Act, 1891; consult section 2, also in Part II, under 'Water Rights,' sections 60 to 80, and in Part V. under 'Water,' sections 130 to 136—(M).

1891—Apr. 20, chap. 26, Placer Mining Act, 1891; consult section 2; also Part IV *re* 'Water Rights,' being sections 54 to 78; Part VI *re* Bed-rock Flumes, being sections 100 to 111; and sections 151(k) (l) (m) and 170—(M).

1892—Apr. 23, chap. 47, Water Privileges Act, 1892; defines and regulates powers of companies to divert water for power purposes; consult more especially, preamble and sections 2 to 6.

1894—Apr. 11, chap. 33, Placer Mining Amendment Act, 1894; see sections 2, 8, 9, and 10—(M).

1894—Apr. 11, chap. 12, Drainage, Dyking and Irrigation Act, 1894; consult sections 2, 10, 12, 16 and 64.

1895—Feb. 21, chap. 34, Line Fences and Water-courses Amendment Act, 1895; see sections 2 and 3.

1895—Feb. 21, chap. 39, Mineral Act, Amendment Act, 1895; see section 2—(M).

1895—Feb. 21, chap. 40, Placer Mining Act, 1891, Amendment Act, 1895; see section 2—(M).

1896—Apr. 17, chap. 34, Mineral Act, 1896; consult section 2; also in Part II, under 'Water Rights,' being sections 59 to 79; in part V, under 'Water,' being sections 128 to 134; and section 157—(M).

1896—Apr. 17, chap. 35, Placer Mining Act Amendment Act, 1896; see sections 2, 14, 15 and 16—(M).

1897—May 8, chap. 29, Placer Mining Act (1891) Amendment Act, 1897; see section 3—(M).

1897—May 8, chap. 45, Water Clauses Consolidation Act, 1897.

1897—*Revised Statutes of British Columbia*, 1897; chapter 190 is the Water Clauses Consolidation Act, 1897 (chap. 45, 1897); chapter 64 is the Drainage, Dyking and Irrigation Act, 1894 (being chap. 12, 1894, as amended in 1895 and 1896); chapter 76 is the Line Fences and Water-courses Act (Cons. Acts, 1888, chap. 45, as amended in 1894, 1895 and 1896); chapter 113 is the Land Act (Cons. Acts, 1888, chap. 66, as amended in 1890-1-2-3-4-5-6 and 7); chapter 135 is the Mineral Act, 1896 (chapter 34, 1896); chapter 136 is the Placer Mining Act, 1891 (being chap. 26, 1891, as amended in 1895, 1896 and 1897); chapter 168 is the Rivers and Streams Act, 1890 (chap. 43, 1890); chapter 115 is the English Law Act (Cons. Acts, 1888, chap. 69).

1899—Feb. 27, chap. 37, Department of Lands and Works Act, 1899; see sections 10 and 11.

1899—Feb. 27, chap. 77, An Act to Amend the Water Clauses Consolidation Act, 1897; see sections 1 and 2.

1900—Aug. 31, chap. 44, An Act to Amend the Water Clauses Consolidation Act, 1897.

1901—May 11, chap. 25, British Columbia Fisheries Act, 1901; see sections 26 and 54.

1901—May 11, chap. 38, Placer Mining Act Amendment Act, 1901; see section 4.

1901—May 11, chap. 64, Wood Pulp Act, 1901; this Act provides against summary cancellation of water rights (see section 2).

1902—June 21, chap. 56, Power Companies Relief Act, 1902.

1902—June 21, chap. 72, Water Clauses Consolidation Act, 1897, Amendment Act, 1902.

1903—May 4, chap. 28, Water-courses Obstruction Act, 1903.

1904—Feb. 10, chap. 56, Water Clauses Consolidation Act, 1897, Amendment Act, 1904.

1905—Apr. 8, chap. 34, Land Act Further Amendment Act, 1905 ; see section 2.

1905—Apr. 8, chap. 55, Water Clauses Consolidation Act, Amendment Act, 1905.

1906—Mar. 12, chap. 47, Water Clauses Consolidation Act, 1897, Amendment Act, 1906.

1907—Apr. 25, chap. 14, Ditches and Water-courses Act, 1907.

1907—Apr. 25, chap. 18, Line Fences Act, Amendment Act, 1907.

1907—Apr. 25, chap. 47, Water Clauses Consolidation Act, 1897, Amendment Act, 1907.

1907—Apr. 25, chap. 33, Rivers and Streams Act, Amendment Act, 1907.

1908—Mar. 7, chap. 56, Water Clauses Consolidation Act, 1897, Amendment Act, 1908.

1909—Mar. 12, chap. 48, Water Act, 1909.

1910—Mar. 10, chap. 52, Water Act, 1909, Amendment Act, 1910.

1911—Mar. 1, chap. 59, Water Act, 1909, Amendment Act, 1911.

1911—*Revised Statutes of British Columbia*, 1911 ; chapter 239 is the Water Act, 1909 (chap. 48, 1909, as amended) ; chapter 69 is the Drainage, Dyking and Irrigation Act (R.S. 1897, chap. 64, as amended by chap. 19, 1901) ; chapter 84 is the Line Fences Act (R.S. 1897, chap. 76, as amended by chap. 19, 1903-4) ; chapter 129 is the Land Act, 1908 (chap. 30, 1908) ; chapter 157 is the Mineral Act (R.S. 1897, chap. 135, with later amendments); chapter 165 is the Placer Mining Act (R.S. 1897, chap. 136, as amended).

1912—Feb. 27, chap. 49, Water Act Amendment Act, 1912.

1913—Mar. 1, chap. 82, Water Act Amendment Act, 1913.

1914—Mar. 4, chap. 81, Water Act, 1914.

1915—Mar. 6, chap. 65, Pulp and Paper Companies' Water Agreement Act.

1917—May 19, chap. 75, Water Act, 1914, Amendment Act, 1917.

BRIEF MEMORANDUM RESPECTING PROCEDURE TO OBTAIN A WATER LICENSE

The following outline of procedure will assist an applicant for a water license for power purposes to understand clearly the procedure demanded by the British Columbia Water Act. The applicant should, however, early establish communication with the Provincial Water Rights Branch and be in touch also with the Engineer and Water Recorder of the Water District. The Water Rights Branch will furnish all essential information and gladly co-operate to guide the applicant.

In successively passing the various essential stages of obtaining his Certificate of Approval, when necessary ; the Permit to make surveys, if required ; the conditional water license ; and eventually the final water license ;

the applicant is greatly assisted by the various forms provided by the provincial authorities—although in some cases the use of the forms is optional. In dealing with the successive steps, these forms are herein referred to by the respective numbers. From time to time it may be found necessary to modify somewhat present procedure, or even to change some of the forms now in use; such changes, however, will not affect the general usefulness of this outline of procedure, because the forms now in use and the procedure followed are in accord with the general principles embodied in the Water Act—principles, indeed, which are basic to the whole water legislation of the province.

First Step

Posting Notice—Notice must be posted in certain conspicuous places. Providing the information required is given, no special forms are demanded. Forms are however provided : No. 101, suitable for an application to take and use water ; No. 102, suitable for an application to store or pen back water ; and No. 103, combining, in a single form, the features of Nos. 101 and 102. (See Sec. 70 of Water Act.)

Second Step

Filing and Serving Copies of Notice—After posting notice in Step One, notice to the same effect must be filed in the office of the Water Recorder for the district and served upon each owner whose land will in any way be affected. No particular form is specified, and same form as is used in Step One may be employed. Proof of this step having been taken is later required. (See Sec. 71.)

Third Step

Advertisement—Published notice, similar to posted notice, but containing, in addition, the date of the first appearance of such notice in a local newspaper, and a statement that objections may be filed with the Comptroller or with the Water Recorder within thirty* days, is to be inserted once a week for four weeks in a local newspaper, in every water district affected, and, in the case of Class C licenses—a class which includes licenses for power to be sold†—the notice must also be published for two weeks in the *British Columbia Gazette* and must state, in addition, that the petition for approval of the undertaking will be heard in the office of the Board of Investigation at a date to be fixed by the Comptroller, and that any interested person may file objection. (See Sec. 72.)

Fourth Step

The Application—Within ten days after the first appearance of the notice in the local newspaper, the applicant must file with the same Water Recorder an application and sketch. The application must be in duplicate on Form

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* The period of 30 days specified in Sec. 72 is stated to be an error, and should be the same as the period of 50 days mentioned in Sec. 77. Doubtless, in administering the Act, the full 50 days would be allowed for objections to be entered, even though the advertisement in the newspaper notifies the intending objector that he has only 30 days for this purpose.

† See p. 89 for definition.

104. It is recognized that at this stage the information in possession of the applicant may be somewhat meagre. Pending accurate surveys, information respecting the head obtainable, the extent to which storage may be rendered available and the regimen of the stream involved, may all be uncertain. Nevertheless, the applicant should give all available information, and the sketch, although it need not be drawn to scale, must show (*a*) the course of the stream ; (*b*) the proposed point of diversion ; (*c*) the situation of all principal works, such as ditches, dams, reservoirs, etc.; (*d*) the boundaries and lot numbers of the land on which water is to be used ; (*e*) the particular place of use ; (*f*) the boundaries, lot numbers and names of owners of lands in any wise affected.

At this step the Water Recorder, having first endorsed on the duplicate application the date of its filing, forwards it to the Comptroller, together with copy of posted notice previously filed. Communication is made by means of Form 105.

Fifth Step

Additional Information Required—Upon receiving the application, the Comptroller sends forms and a printed letter, on Form 107, requesting additional information and asking that certain fees be paid before a certain date ; which date is to be within 50 days of first appearance of notice in local newspaper.

Sixth Step

Payment of Fees—The payment of fees constitutes the sixth step. Although so called in the Act, this sixth step is not so much an isolated step following Step Five, as it is a step closely associated with the procedure of Step Five. It is counselled that the fees, in any event, be promptly remitted, because, if this is done and unavoidable delays should chance to occur in returning the forms connected with Step Five, an extension of time may be obtained.

Fifth Step—(*Continued*)

The forms sent by the Comptroller are Form 108, Applicant's Letter, and Form 106, Proof of Posting, Serving and Publishing Notice. The information called for at this stage of the procedure varies with the different classes of licenses, and will be clearly indicated to the applicant by the forms themselves. Thus, in the case of a Class C application, it is necessary to supply the information specified in Secs. 75 (1) (*k*) and 75 (1) (*m*) of the Act.

Certificate of Approval—The obtaining of a Certificate of Approval of the undertaking is a very important part of the procedure leading to the granting of a Class C license. The applicant should carefully study and conform to the requirements set forth in Secs 77 to 84 of the Water Act, 1914. These sections describe the information which the applicant must specifically furnish, to whom, and what notices shall be sent, the procedures respecting the ***hearing of petition***, **and the issuance and publication of the certificate. (Consult, also, Chap. IV herein.)**

SEVENTH STEP

Surveys and Further Publication—After the certificate of approval has been granted, the applicant may obtain a permit to make surveys, and, after giving security for the payment of compensation for damages, etc., may proceed with the necessary surveys.* The authorization to make surveys is on Form 1,001, and specifies the time within which the plans, specifications and detailed estimates of cost of works involved must be completed and filed, in duplicate, with the Comptroller.

It is very important that all applicants for water license should understand the class and scope of information which must be furnished by the plans and specifications required to be submitted prior to the granting of a conditional license. These requirements are set forth on Form 1,000, which should be carefully studied.

When the applicant has prepared the information and plans, they are forwarded to the Comptroller, with an *Application for the Approval of Plans* on Form 150, which gives the estimated cost of the entire works and the time required for their completion.

Having filed the plans, the applicant—as soon as he is advised by the Comptroller that same are in order and copies have been filed with local Water Recorder—publishes a notice once a week for four consecutive weeks in a local newspaper and in two consecutive issues of the *British Columbia Gazette*, that the plans have been filed and are open to inspection in the office of the local Water Recorder. The applicant must also serve a copy of the notice on every party whose land is affected. The notice is prepared on Form 151. (See Sec. 80 (5) and (6).)

CONDITIONAL LICENSE—The Comptroller takes into consideration all matters relating to the application, including the date of the application itself, all subsequent proceedings, the objections filed, the Certificate of Approval, etc., and, after approving the plans, he may issue a Conditional License. As issued to a power company, the form used is No. 1,003.† (See Sec. 91.)

Accompanying and forming an essential part of the Conditional License are two exhibits—'A' and 'B.' Exhibit 'A' includes a plan showing the point of diversion from the stream and furnishes, in addition, a description of the lands upon which the power is to be generated, and of the territory

* The Board of Investigation is authorized to secure such information by means of surveys and special investigations as may be necessary for its deliberations, and if such surveys are required *before* the granting of the Certificate of Approval (see Secs. 86 and 87), the Board may order the obtaining of such information, either through its field officers, or by such other means as the Board may order. (See Secs. 79, 80 and 81.)

†Conditional license for domestic, mining, miscellaneous, Form 1,002 ; for irrigation, Form 1,004 ; for storage, Form 1,008 ; and for clearing streams, Form 1,009. In any development involving storage, it is required by the Act, Sec. 11 (3), that separate licenses be issued for diversion and for storage. The procedure for obtaining the two licenses may be combined in the posting of notices and in all subsequent steps. The Comptroller may consider such applications concurrently, but he must, nevertheless, issue the licenses separately. An independent application for a license for storage could, of course, be made by a holder of a license for diversion. The Storage License, in every case, is subservient to the "diversion" license. This is clearly seen from the preamble and other statements in the Forms (No. 1,008 and No. 1,024) for conditional and final water licenses for storage.

within which such power may be disposed of. Exhibit 'B' describes and approves the plans and specifications, and is on Form 1,005.

The Conditional License also embodies the Certificate of Approval and, with exhibits A and B, defines fully and specifically the powers and privileges conferred under the Act upon the licensee.

Eighth Step

Taking of Lands and Construction of Works—Having secured a Conditional License, the applicant may proceed with his works. If it is necessary to enter upon Crown lands, the applicant must obtain a permit from the Minister, and to this end must forward a petition, accompanied by a satisfactory plan or section showing his requirements in this matter. (See Secs. 92, 93, 94 and 95.)

Such subjects as the procedure of applicant with respect to his entry or construction of works on private lands, the compensation to be paid, also the arbitration and various procedure to be followed, are dealt with in Secs. 96 to 116, of the Water Act.

Ninth Step

Filing Proof of Completion—On completion of his works the applicant must file proof of completion, making use of Form 153. This states that the works are completed and the water put to beneficial use (in whole or in part). This proof must be furnished within 60 days of the date for completion fixed in the Conditional License.

Final License—Upon the filing of satisfactory proof (Sec. 117), or upon an inspection by provincial authorities, which demonstrates, to the satisfaction of the Comptroller, that the terms of the Conditional License have been complied with, a Final License is issued for such portion of the water recorded as has been put to beneficial use. The Final License for 'Class C' is issued on Form 1,022 ; for domestic, mining and miscellaneous, on Form 1,021 ; irrigation, on Form 1,023 ; storage, on Form 1,024 ; and clearing streams, on Form 1,025.

TYPICAL VIEW OF THE DRY BELT COUNTRY

Valley of the Thompson river. Note scattered timber on the slopes and thicker cover near summits of the hills, also appearance of the soil.

CHAPTER IV

Certificates of Approval—Orders in Council—Fees

UNDER the water legislation of British Columbia a 'Final License' is essential, as representing a grant of water-power rights and privileges. Of this final license, a 'Certificate of Approval of Undertaking' forms an integral part.* The certificate sets forth, specifically, the chief physical features of the undertaking. It must be published in the *British Columbia Gazette*, but publication of the final license is not required. The *Gazette*, therefore, usually constitutes the readiest source from which to obtain information respecting individual grants of water-power rights and privileges. A list of certificates of approval and orders in council relating chiefly to water-power companies, with page references to the *Gazette*, is contained in this chapter.†

With respect to the history of these certificates of approval, and the significance of certain dates relating thereto, it may be pointed out that under the 'Water Clauses Consolidation Act, 1897,' 'a power company,' as defined in secs. 78-83 of said Act, could, subsequent to and consequent upon the filing of certain documents specified in sec. 85, obtain the approval of the Lieut.-Governor in council (sec. 86), who, by sec. 87, was empowered to issue a certificate of approval of the undertaking. This certificate was deemed to form part of the memorandum and articles of association of the company (sec. 88). It specified the amount of capital to be subscribed and the time within which any portion of the capital was to be available in respect of any specified portion of the undertaking and works ; it also fixed the time for the commencing and completion of the works or portions thereof. A copy of the certificate was to be published for one month in the *British Columbia Gazette*, and in a newspaper published or circulated within the area in which the undertaking and works were to be carried on. A certified copy was also to be filed in the office of the Commissioner and Gold Commissioner having territorial jurisdiction in said district (sec. 87).

As the Lieut.-Governor in council could vary the terms and conditions of the first certificate issued, from time to time orders in council were passed, granting extension of time or other modifications with respect to the undertaking.

* Where such is required. See Chapter III, pp. 73, 74, 76, 77, 87, 91.

† NOTE—*Re* consulting the Index to the *British Columbia Gazette*, with reference to matters relating to water, note that previous to 1909, 'Certificates of Approval' are usually indexed under *Provincial Secretary's Department* ; 'Reserves on Water' and 'Cancellations of Reserves' under *Lands and Works*—sub-heading *Reserves*. Other references may be found under *Orders in Council* and *Proclamations*, both Dominion and Provincial, and, also, occasionally, under the heading *Miscellaneous*. Subsequent to the year 1909, such matters are generally segregated in the index under *Water Notices* and subsequent to the establishment of the Water Rights Branch, under the two headings *Water Rights Branch* and *Water Notices* ; also, consult under other headings mentioned above.

A change in the wording of sec. 85 of the 'Water Clauses Consolidation Act, 1897, Amendment Act, 1908,' made it clear that a power company, "before proceeding with the construction of its works," shall apply to the Lieut.-Governor in council for the approval and "shall obtain a certificate of approval of its undertaking," and shall also give notice of such intention by a notice inserted in the *British Columbia Gazette* and in any newspaper published and circulated in the district in which the works are to be constructed. It should be noted, however, that, prior to the passing of the 'Water Act, 1909, Amendment Act, 1912,' the license might be obtained *before* the certificate of approval.

By the 'Water Act, 1909,' any municipality or company that had obtained a license for more than four cubic feet of water per second was required (sec. 83) to obtain approval of the proposed undertaking and works by the Lieut.-Governor in council, who was empowered (sec. 89) to issue a certificate, signed by the clerk of the Executive Council, approving the proposed undertaking and works. This certificate was deemed to be conclusive evidence in any court of law.*

The 'matters and things' to be set forth by the certificate were as follows :†

"(*a*) The amount of the capital of the company which shall be subscribed and the amount actually paid up, before the company shall begin the construction of the works ; or,

"(*b*) If the work has been divided into parts, then the amount of capital to be subscribed and actually paid up in respect of each part, before beginning the works on each particular part ;

"(*c*) The time within which the works shall be begun and, if divided, then the time within which each part shall be begun ;

"(*d*) The time within which the works shall be completed and in actual operation ;

"(*e*) The area within which the company may exercise its powers."

The 'Water Act Amendment Act, 1912,' repealed the provisions of parts V and VI of the 'Water Act, 1909,' relating, respectively, to procedure in general and to the approval of undertakings and, also, stipulated that licenses for the taking and using of water, for municipal or power purposes, could only be obtained by a municipality or company *after* the approval of the undertaking by the Lieut.-Governor in council. (See '75' under sec. 27.)

Under the 'Water Act Amendment Act, 1913,' instead of the certificate of approval being granted by the Lieut.-Governor in council and signed by the clerk of the Executive Council, it was granted by, and under the hand of, the Minister of Lands.

Water Act, 1914

The various sections as amended, dealing with the issuance of a certificate of approval, have been embodied in the 'Water Act, 1914.' Under it, the Minister of Lands (sec. 81) may issue a certificate of approval setting forth that the proposed undertaking has been approved, subject to such alterations, limitations, restrictions and conditions as, in the public interest, he may deem just.

*See sec. 318, 'Water Act, 1909' ; also sec. 323 of the *Revised Statutes of 1911* ; also see 'Water Act Amendment Act, 1912,' sec. 66, and compare sec. 93 of the 'Water Act Amendment Act, 1913,' and secs. 27 and 91 (3) of the 'Water Act, 1914.'

†See sec. 90. These 'matters and things' are similar to those called for by sec. 87 of the Act of 1897.

Certificates of approval under the present Water Act are required only in the case of 'Class C' applications (see sec. 79-86) ; and, further, no authorization to make surveys and no water license shall issue to 'Class C' applicants without the express approval of the Minister (see sec. 11-(4) (5).)

In granting new licenses, the provincial authorities aim to issue an instrument which shall clearly set forth, with adequate detail, the rights and obligations of the licensee, as well as a comprehensive description of the chief physical features relating to the use of the water in question.

Under the present Water Act, the certificate of approval is issued before either a conditional or a final license, and, in each case, forms part thereof. It has no further force or effect should the license, for any reason, become void.

The 'matters and things' required by sec. 82 to be set out in the certificate of approval deviate but little from the corresponding clauses of the earlier acts. This section requires a statement of "the amount of the bond (if any) which will be required as security for the payment by the applicant of all costs in connection with the investigation by the Department of his application."

As heretofore, the certificate may be amended, varied and altered, or further certificates may be issued (sec. 83), while sec. 84 states :

"A copy of every certificate issued or amended under the last three preceding sections, certified under the hand of the Minister, shall be filed with the Comptroller, the Water Recorder of 'every district affected,' and such other person as the 'rules' may require, and, in the case of companies, with the Registrar of Joint Stock Companies, and shall be published at the expense of the applicant, once in the *Gazette* and once in a local newspaper in each district included in the territorial limit of the undertaking."

CERTIFICATES OF APPROVAL AND CERTAIN OTHER ORDERS IN COUNCIL RELATING TO THE DIVERSION OF WATER CHIEFLY FOR POWER PURPOSES

Grantee	Streams affected	Date of Certificate of Approval or Order in Council	Published in *British Columbia Gazette*		Remarks
			Date	Page	
Adams River Lumber Co....	Bear creek, lower Adams r., Adams l., Chase ck. (tributarySouth Thompson)	Apr. 18, 1914	May 7, 1914	2720	Approves undertaking. Relates to floating logs and timber.
do	do	July 17, 1916	Aug. 10, 1916	1655	Approves undertaking.
Alberni Water Works Co. [Inc. July 2, 1908].	Roger creek......	Apr. 13, 1909	....	.....	To expropriate water record No. 11.
Armstrong Power and Light Co. [Inc. Aug. 20, 1906].	Fortune creek ...	....	....	.....	Consult an Act for the relief of the Armstrong Power & Light Co., Ltd., 1909, chap. 3, B.C. Statutes.*
Ashcroft Water, Power & Light Co. [Inc. Feb. 25, 1898].	Bonaparte river..	May 6, 1898	May 12, 1898	1005	Approves undertaking.
Belgo-Canadian Fruit Lands.	Ideal lake, North fork Mission ck.	Oct. 18, 1910	....	.....	Approval of certain works.
do	....	Mar. 28, 1911	Apr. 27, 1911	5250	Approves undertaking.
Bella Coola Pulp & Paper Co.	New Memis creek	Nov. 6, 1902	....	.....	Grants water record.
Bella Coola Telephone, Light & Power Co. [Inc. May 13, 1908]	Skomahl river .	Oct. 13, 1909	Oct. 14, 1909	5058	Approves undertaking.
do	....	June 22, 1910	June 23, 1910	5946	Approves amendment and authorizes extension.
Britannia Power Co. [Inc. Oct. 28, 1903].	Britannia creek, Howe sound	Mar. 2, 1905	Mar. 2, 1905	385	Approves undertaking.
do	....	May 13, 1908	....	.....	Crown grant of certain lands.
rittingham and Young Co..	Mesliloet (Indian) r. and Salmon r., Orfordbay, Bute inlet	Oct. 19, 1909	....	.....	Authorized to proceed with undertaking.
do.	do.	Nov. 28, 1911	....	.....	Grants extension of time.
do.	....	Jan. 18, 1912	Feb. 1, 1912	817	Approves of assignment of license.
British-American Dredging Co.	Pine creek......	June 26, 1903	Aug. 6, 1903	1686	Approves undertaking and acquisition of water record.
do.	....	July 27, 1905	July 27, 1905	1590	Approves undertaking.
do.	....	Sept. 14, 1907	Sept. 14, 1907	6163	Authorizes change of name to British Columbia Electric Mining Co., Ltd.
British Columbia Electric Railway Co.	....	....	....	.....	See Vancouver Power Co. and Vancouver Island Power Co.
British Columbia Power and Electric Co.	Cheakamus river.	Sept. 4, 1914	Apr. 8, 1915	997	Approves undertaking.
Campbell River Power Co. [Inc. Apr. 17, 1909].	Campbell river, Vancouver Id.	July 14, 1913	July 24, 1913	6306	Approves undertaking.
Canadian Collieries, Ltd.....	....	....	....	.....	See Wellington Colliery Co.
Canadian Industrial Co. (see Pacific Coast Power Co.).	Powell river.....	Dec. 12, 1906	Dec. 13, 1906	4073	Approves undertaking.
do.	....	Dec. 24, 1906	....	.....	Grant of pulp leases.
do.	....	Sept. 22, 1909	....	.....	Grants extension of time.
Cascade Water, Power and Light Co.	Kettle river......	Feb. 2, 1899	Feb. 5, 1899	145	Approves undertaking.
do.	....	June 22, 1900	....	.....	Confirmation and approval of above certificate.
do.	....	July 13, 1900	....	.....	Grants extension of time.
do.	....	Jan. 27, 1902	....	.....	Grants further extension of time.
Cassiar Power and Industrial Co. [Inc. June 28, 1901].	Fall creek.......	July 26, 1901	....	.....	Grants record.
do.	....	July 30, 1901	Aug. 1, 1901	1256	Reserve of lands for selection of timber limits.
Couteau Power Co. [Inc. Oct. 19, 1908].	Shuswap river	Feb. 19, 1912	....	.....	Certificate of approval, subsequently superseded.
do.	....	Dec. 31, 1912	....	.....	
do.	....	Aug. 28, 1913	Sept. 18, 1913	7489	Approves undertaking.
do.	....	June 30, 1914	July 30, 1914	4428	Grants extension of time.
do.	....	Aug. 21, 1915	Oct. 14, 1915	2913	Grants further extension of time.
do.	....	Oct. 19, 1916	Nov. 2, 1916	2350	Grants further extension of time.
Cranbrook Electric Light Co.	St. Mary river and lake	May 2, 1907	May 23, 1907	2751	Approves undertaking.
do.	....	May 2, 1907	July 11, 1907	4147	Approves slight amendment to above certificate.
do.	....	Nov. 2, 1908	....	.....	Crown grant of lot 6320A, Kootenay district.
do.	....	Oct. 13, 1909	....	.....	Grants extension of time.
do.	....	Dec. 20, 1909	Dec. 30, 1909	6951	Approves change in height of dam, from 30 to 60 feet, and grants extension of time.

* This company failed to apply for a certificate of approval and a special act was passed to put said company in the same position as if it had duly applied.

CERTIFICATES OF APPROVAL AND CERTAIN OTHER ORDERS IN COUNCIL RELATING TO THE DIVERSION OF WATER CHIEFLY FOR POWER PURPOSES—*Continued*

Grantee	Streams affected	Date of Certificate of Approval or Order in Council	Published in *British Columbia Gazette*		Remarks
			Date	Page	
Crows Nest Pass Electric Light and Power Co.	Elk river	Mar. 8, 1906			Approves undertaking.
do.		Mar. 16, 1909			Agreement with telephone company.
Cummings, Alfred, of Fernie	Linklater creek	Oct. 12, 1911	Nov. 9, 1911	15758	Authorizes construction of works.
Daly Reduction Co. [Inc. Mar. 7, 1903].	Unnamed creek and Twenty-mile (Hedley) ck.	July 30, 1903	Aug. 6, 1903	1686	Approves undertaking and plans.
Denver Light and Power Co. [Inc. Mar 2, 1903].	Carpenter creek, Slocan lake	July 23, 1903	July 23, 1903	1573	Approves undertaking.
Denver Water Works Co. [Inc. Aug. 20, 1904.]		Mar. 24, 1905			Grants application.
Elko Water, Light and Power Co.	Silver Spring lake, Elk river	Oct. 19, 1916	Dec. 28, 1916	2741	Approves undertaking.
Fernie, city of	Fairy creek	Aug. 10, 1906			Adjudication confirmed.
do.		Mar. 31, 1909			Adjudication confirmed.
do.		Mar. 3, 1910	May 19, 1910	4140	Approves undertaking. Water supply for Fernie and vicinity.
Ganges Water and Power Co.	No. 1. spring and Maxwell lake, Salt spring Id.	Sept. 4, 1914	Sept. 17, 1914	5653	Approves undertaking. Water supply to certain parts of North division of Salt Spring island.
Gilley Bros., Ltd.	Dennet lake and Munroe creek, Pitt river	Sept. 4, 1914	Sept. 17, 1914	5652	Approves undertaking.
Grand Forks Water, Power and Light Co. [Inc. May 8, 1897].	Granby (North fork Kettle) river	Sept. 18, 1899	Sept. 21, 1899	1613	Approves undertaking.
do.		Nov. 22, 1899			Grants leave to expropriate land.
Greenwood City Water Works Co.	Boundary and Copper creeks	June 16, 1906	June 21, 1906	1620	Approves undertaking.
Industrial Power Co. of B.C. [Inc. July 19, 1899].	Fairy falls, Clowhom river, Salmon Arm	July 10, 1900	July 12, 1900	1158	Approves undertaking.
Island Power Co. [Inc. Mar. 27, 1907].	Campbell river	Aug. 8, 1901			Approves grant of water.
Kamloops, city of	Barriere river	Aug. 27, 1914	Aug. 27, 1914	5184	Approves undertaking.
Kamloops Irrigation and Power Co. [Inc. Sept. 13, 1900].	Bonnard, McQueen, Dairy and Jamieson cks. (trib. North Thompson)	Nov. 14, 1902	Nov. 27, 1902	2170	Approves undertaking and plan.
do.	do.	Mar. 25, 1903	Mar. 26, 1903	573	Approves undertaking.
Kamloops Fruitlands, Irrigation and Power Co.		Apr. 27, 1910	May 19, 1910	4139	Approves schedule of rates.
Kaslo City water-works		Mar. 7, 1905			Approves grant of water record.
Keremeos Land Co. [Inc. June 17, 1907].	Ashnola river	July 8, 1907	Sept. 19, 1907	6163	Approves undertaking.
Kootenay Air Supply Co. [Inc. Sept. 13, 1897].	Coffee creek, Kootenay river	Mar. 4, 1898	Mar. 10, 1898	595	Approves undertaking.
Lardeau Light and Power Co. [Inc. Apr. 2, 1901].	South fork, Lardeau river	May 3, 1901	May 9, 1901	765	Approves undertaking and plans.
Mission Water, Light and Power Co.	Silver creek, Nicholson creek	Mar. 25, 1914	Apr. 16, 1914	2342	Approves undertaking. Water supply to vicinity of Mission.
Mother Lode Sheep Creek Mining Co.	Sheep creek	June 14, 1911			Approves water license.
Nairns Falls Power Co.	Nairns falls, Green river	Sept. 4, 1914	Dec. 10, 1914	6799	Approves undertaking.
Nanaimo Electric Light Power and Heating Co.	Millstone river	May 19, 1904	May 19, 1904	948	Approves undertaking and plans.
Nanaimo City water works	South fork, Nanaimo river	Apr. 31, 1908			
Nelson City hydro-electric power.	Kootenay river	Mar. 29, 1905	Mar. 30, 1905	583	Approves undertaking.
Nelson City water works	Anderson creek	Jan. 6, 1898			Approves grant of water.
Newport Water Co.	Staamus river, Howe sound	Oct. 24, 1913	Nov. 6, 1913	8407	Approves undertaking. Water supply to lots 486, 833, 912 and 957, Group 1, Westminster district and Squamish Indian Reserve.
do.		Mar. 3, 1914	May 28, 1914	3082	Grants right-of-way.

CERTIFICATES OF APPROVAL AND CERTAIN OTHER ORDERS IN COUNCIL RELATING TO THE DIVERSION OF WATER CHIEFLY FOR POWER PURPOSES—*Continued*

Grantee	Streams affected	Date of Certificate of Approval or Order in Council	Published in *British Columbia Gazette*		Remarks
			Date	Page	
North Vancouver, District of	Lynn creek, Mosquito creek, creeks in District lots 802, 785, 882, 881 and Rice lake	July 22, 1904	....	.....	Approves assignment of 300 inches.
do.	do.	Aug. 27, 1904	Sept. 15, 1904	1736	Approves undertaking.
do.	do.	Oct. 12, 1904	Oct. 13, 1904	1952	Approves undertaking. Amended certificate.
North Vancouver, city of....	do	Aug. 16, 1906	....	.....	Adjudication approved re water records, Seymour creek.
do.	....	June 2, 1908	....	.....	Adjudication approved.
do.	....	Aug. 27, 1908	Sep. 3, 1908	3255	Approves undertaking.
do.	....	Feb. 1, 1912	....	.....	Approves application for lots 856 and 857 for water works.
do.	....	Jan. 8, 1914	Feb. 5, 1914	800	Approves undertaking. Extension of water supply, North Vancouver.
Ocean Falls Co............	Link lake and river	Dec. 31, 1912	....	.....	Approves plan and profile of 9 bridges.
Oriental Power and Pulp Co. [Inc. July 15, 1901].	Finlay river and lakes, Princess Royal island	Jan. 8, 1902	....	.....	Approves record.
do.	....	Feb. 25, 1907	Feb. 28, 1907	865	Approves undertaking and plans.
Pacific Coast Power Co. [Inc. Sept. 18, 1899] (see also Canadian Industrial Co.).	Powell river......	Oct. 2, 1899	Oct. 5, 1899	1707	Approves undertaking.
do.	....	July 10, 1900	July 12, 1900	1158	Approves undertaking.
do.	....	July 3, 1902	....	.....	Grants extension of time.
do.	....	July 29, 1903	Aug. 6, 1903	1685	Approves undertaking and plan.
do.	....	Sept. 22, 1904	Sept. 22, 1904	1789	Approves undertaking and plan.
do.	....	Dec. 12, 1906	Dec. 13, 1906	4073	Approves undertaking.
Pacific Pulp and Power Co. [Inc. Aug. 9, 1906].	Union creek and tributaries	Mar. 26, 1907	Apr. 4, 1907	1344	Approves undertaking.
do.	....	Feb. 28, 1911	....	.....	Grants extension of time.
do.	....	Mar. 20, 1912	Mar. 21, 1912	2305	Grants further extension of time.
Penticton District Municipality.	Penticton creek...	Nov 1, 1911	July 4, 1912	6177	Approves undertaking and plans.
Pine Creek Power Co. [Inc. June 28, 1901].	Pine creek and Surprise lake	Aug. 29, 1901	Aug. 19, 1901	1400	Approves undertaking and plan.
do.	....	Nov. 26, 1906	Nov. 29, 1906	3827	Approves undertaking.
Placer Gold Mines..........	Ruby creek, Atlin district	July 15, 1910	July 21, 1910	7715	Approves undertaking.
Port Alberni, city of........	China creek, Alberni canal	Dec. 27, 1913	Apr. 30, 1914	2590	Approves undertaking. Water-supply to municipality.
Port Coquitlam, city of.....	Gold creek, Coquitlam river	Oct. 19, 1916	Nov. 9, 1916	2391	Approves undertaking as amended.
Port Edward Townsite Co...	Wolf creek.......	Dec. 1, 1913	Dec. 26, 1913	9451	Approves undertaking. Water supply to lot 446, rge. 5, Coast district.
Port Essington Water Co....	Cunningham lake and ck, Skeena river	Jan. 7, 1914	Feb. 5, 1914	874	Approves undertaking. Water supply for townsite, Port Essington.
Port Moody, city of........	Noons creek, Burrard inlet; Scott creek, Coquitlam river	Mar. 29, 1915	May 6, 1915	1318	Approves undertaking. Water supply to city of Port Moody.
Powell River Paper Co......	Powell river......	Jan. 2, 1912	....	.....	Approves construction of paper mill.
Prince George, city of........	Nechako river....	Oct. 6, 1916	Nov. 16, 1916	2450	Approves undertaking. Water supply to Prince George and district.
Prince Rupert Power and Light Co. [Inc. June 30, 1906.]	Shawatlan lake, river and tributaries	Feb. 22, 1907	Feb. 28, 1907	866	Reservation of 300 inches on all streams in Tsimpsean peninsula.
do.	Woodworth lake, Pine creek	June 7, 1907	....	.....	Record amended from 2,000 to 5,000 miners' inches.
do.	....	Mar 16, 190[illegible]	Apr. 2, 1908	1373	Approves undertaking and diversion.
do.	....	Apr. 30, 1908	May 7, 1908	1755	Approves undertaking.
do.	....	May 19, 1908	May 21, 1908	1888	Approves undertaking. This certificate supersedes those dated Mar. 16 and Apr. 30.
do.	....	Aug. 11, 1908	Aug. 13, 1908	2950	All unrecorded water of McNicholl's creek reserved for municipalities.
do.	....	Mar. 9, 1909	....	.....	Grants extension of time.
do.	....	Jan. 2, 1912	....	.....	Cancelling two water licenses and transferring same to Prince Rupert

CERTIFICATES OF APPROVAL AND CERTAIN OTHER ORDERS IN COUNCIL RELATING TO THE DIVERSION OF WATER CHIEFLY FOR POWER PURPOSES—*Continued*

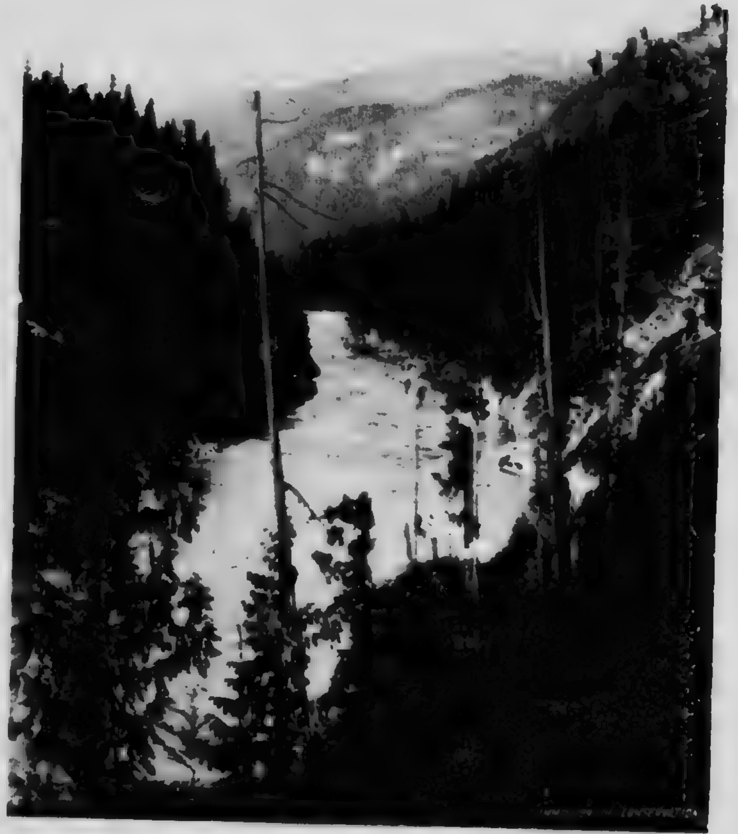
Grantee	Streams affected	Date of Certificate of Approval or Order in Council	Published in *British Columbia Gazette*		Remarks
			Date	Page	
Prince Rupert, city of	Woodworth and Shawatlan lakes and Thulme r., Wark channel	Jan. 7, 1914	Apr. 2, 1914	2085	Approves undertaking and assignment of licenses 203 and 214.
do.	do.	Mar. 10, 1915	Apr. 22, 1915	1137	Approves undertaking as far as it relates to application for license.
Quesnelle Hydraulic Gold Mining Co.	Swift river	Mar. 31, 1911	Apr. 13, 1911	4571	Approves undertaking.
Quatsino Power and Pulp Co. [Inc. Oct. 20, 1902].	Feettah creek	Oct. 20, 1902	...	...	Approves record.
Rock Creek Irrigation Co. [Inc. Mar. 25, 1907].	Rock creek	May 2, 1907	May 2, 1907	2199	Approves undertaking.
Roger Creek Water Co., Alberni.	Roger creek, Somass river	Oct. 23, 1913	Nov. 6, 1913	8408	Approves undertaking. Municipal supply to city of Alberni.
Rossland Air Supply Co. [Inc. Sept. 30, 1898].	Beaver ck, Salmon r. and North fork Salmon river	Jan. 24, 1899	Jan. 26, 1899	107	Approves undertaking.
Rossland City water-rights	Murphy, Boulder and Blueberry creeks	July 5, 1899	...	...	Grants diversions.
Rossland Water and Light Co.	Stoney, Little Stoney and Little Sheep cks.	Sept. 23, 1899	...	...	Approves and confirms diversions.
Rossland Power Co. [Inc. Aug. 21, 1902].	Murphy, Rock and Stoney cks.	Nov. 5, 1903	Nov. 5, 1903	2457	Approves undertaking and plan.
Salmon Arm, city of	East Canoe creek, Shuswap lake	May 6, 1914	May 21, 1914	2933	Approves undertaking. Water supply to Salmon Arm and vicinity.
Sandon City, water works and Power.	Tributary, Sawmill, Carpenter and Sandon cks.	Mar. 10, 1903	...	...	Question of powers referred to Supreme Court.
do.	do.	Mar. 19, 1903	...	...	Confirms adjudication.
Sidney Water and Power Co.	Supply spring No. 1 and well	Aug. 5, 1913	Aug. 14, 1913	6795	Approves undertaking. Water supply to North Saanich district.
Snohosh Water, Light and Power Co. [Inc. Mar. 23, 1908].	Snohosh lake, Deadman ck.	Mar. 24, 1908	Mar. 26, 1908	1288	Approves undertaking with plans.
Sooke Harbour Water Co.	East fork Sooke river	Apr. 8, 1913	July 17, 1913	6151	Approves undertaking.
Southern Okanagan Power Co. [Inc. Aug. 21, 1905].	Okanagan river, Dog lake outlet	Aug. 10, 1909	Sept. 2, 1909	4069	Approves undertaking.
do.	...	Aug. 21, 1911	...	...	Extends time for completion.
South Vancouver, Municipality of.	Seymour creek	Aug. 16, 1906	...	...	Grants record of 1,000 inches from Seymour creek and additional 300 inches.
Spallumcheen Corporation	Davis creek	Sept. 11, 1906	...	...	Grants record.
do.	do.	May 11, 1909	...	...	Adjudication approved.
Spruce Creek Power Co. [Inc. Feb. 13, 1904]	Spruce creek	Mar. 3, 1904	Mar. 10, 1904	429	Approves undertaking.
Stave Lake Power Co. [Inc. Sept. 15, 1899].	Stave river and tributaries	Apr. 14, 1900	Apr. 26, 1900	694	Approves undertaking with plan.
do.	...	Oct. 9, 1900	...	...	Varies terms of approval and grants extension of time.
do.	...	Sept. 20, 1901	...	...	Varies terms of certificate and grants extension of time.
do.	...	June 21, 1902	...	...	Grants further extension of time.
do.	...	May 12, 1903	...	...	Grants extension of time for completion of waste-way.
do.	...	June 3, 1904	...	...	Grants further extension of time.
do.	...	Dec. 7, 1904	June 22, 1905	1280	Approves amended design and undertaking
do.	...	Oct. 31, 1906	Nov. 22, 1906	3699	Approves undertaking.
do.	...	Sept. 17, 1908	...	...	Grants further extension of time.
do.	...	July 14, 1910	July 14, 1910	7292	Approves undertaking and amends certificate of Oct. 31, 1906.
Surf Inlet Power Co. [Inc. Apr. 9, 1905].	Cougar lake, Princess Royal Id.	Apr. 27, 1905	...	...	Grants diversion.
do.	do.	May 25, 1916	June 1, 1916	1115	Approves undertaking.
Sutton Lumber and Trading Co.	Kennedy river	Sept. 22, 1906	...	...	Grants permission to clear stream.
Thompson Valley Irrigation and Power Co. [Inc. June 8, 1908].	Lake of the Woods, Pennie, Twin and Bull lakes	Mar. 16, 1909	Mar. 10, 1910	1603	Approves undertaking and authorises acquisition of water records controlled by B. C. Horticultural Estates, Ltd.
do.	...	Sept. 28, 1909	Sept. 30, 1909	4710	Schedule of rates.

CERTIFICATES OF APPROVAL AND CERTAIN OTHER ORDERS IN COUNCIL RELATING TO THE DIVERSION OF WATER CHIEFLY FOR POWER PURPOSES—*Continued*

Grantee	Streams affected	Date of Certificate of Approval or Order in Council	Published in *British Columbia Gazette*		Remarks
			Date	Page	
Vancouver, City of.........	Seymour ck. and lake, Capil[illegible] river and Col[illegible] creek	June 14, 1912	Sept. 12, 1912	8538	Approves undertaking.
Vancouver Power Co. [Inc. Jan. 25, 1898].	Coquitlam and Buntzen lakes	Dec. 4, 1901	....	.....	Approves diversion.
do.	....	Feb. 14, 1902	Feb. 20, 1902	246	Approves undertaking.
do.	....	Feb. [illegible], 1903	....	.....	Confirms adjudication.
do.	....	May [illegible], 1906	May 25, 1906	1285	Approves further undertaking with plans.
do.	....	May [illegible], 1908	May 21, 1908	1888	Approves further undertaking.
do.	....	Apr. 22, 1909	....	.....	
Vancouver Island Power Co. [Inc. Jan. 16, 1907.]	Jordan r[illegible] tribs, Tr[illegible] Bear cks [illegible] rant, Tro[illegible] and Heal lakes	Nov. 4, 1909	Nov. 4, 1909	5562	Approves undertaking.
Vernon City water works....	Long lake..	[illegible] 1898	....	.....	Approves record 3,000 inches.
do.	....	Sept. 12, 1905	....	.....	Reserve placed upon 3,000 inches for 1 year for municipal purposes.
do.	....	Aug. [illegible]	....	.....	Reservation extended for another year.
do.	....	June 12, 190[illegible]	[illegible] 1908	2353	Reservation upon 2,000 inches for 2 years approved.
do.	....	Apr. [illegible]	....	.....	Right to expropriate granted.
Victoria Power Co. [Inc. July 17, 1897].	Shawnigan [illegible] and Koksilah	Sept. [illegible]	[illegible]t. 29, 1904	1843	Approves undertaking and plans.
do.	....	Aug. 14, 190[illegible]	....	.....	Approves reservation for Victoria city of all unrecorded water.
do.	....	June 18, [illegible]	....	.....	Approves extension of time.
do.	....	Mar. 1, 1909	....	.....	Approves reservation.
Wellington Colliery Co......	Puntledge river..	Nov. 27, 1911	Dec. 7, 1911	16825	Approves undertaking.
Western Canada Power Co..	....	....	....	.....	See Stave Lake Power Co.
West Kootenay Power and Light Co. [Inc. May 8, 1897].	Kootenay river. Lower Bonnington and Upper Bonnington falls	Nov. 26, 1897	....	.....	Confirms records assigned to Company and approves grant of 200,000 inches.
do.	....	do.	....	.....	Grants right-of-way.
do.	....	Dec. 15, 1902	....	.....	Government's acceptance of Company's proposed terms of settlement of arrears.
do.	....	Apr. 25, 1905	....	.....	Confirms water record and grants right-of-way.
do.	....	Aug. 17, 1905	Aug. 17, 1905	1763	Approves undertaking.
do.	....	Aug. 20, 1906	....	.....	Grants extension of time.
do.	....	Oct. 5, 1908	....	.....	Grants further extension of time.
Westminster Power Co......	Mesliloet river and tributaries. Young, Brandt, Norton and Hixon creeks	June 6, 1913	June 26, 1913	5644	Approves undertaking.
do.	....	July 30, 1915	Sept. 2, 1915	2484	Amends certificate by granting extension of time.
do.	....	July 18, 1916	Sept. 15, 1916	1991	Amends certificate by granting extension of time.
do.	....	Oct. 19, 1916	Nov. 9, 1916	2392	Approves undertaking as amended.
West Vancouver, City of....	Brothers creek, Capilano creek	Apr. 19, 1915	May 20, 1915	1479	Approves undertaking. Water supply to municipality of West Vancouver.
White Valley Irrigation and Power Co. [Inc. Mar. 31, 1906].	Jones or Creighton creek	Aug. 21, 1906	Aug. 23, 1906	2395	Approves undertaking.
do.	....	Nov. 12, 1906	....	.....	Approves rules for measuring water to customers.
do.	....	Nov. 14, 1906	Nov. 22, 1906	3700	Approves schedule of rates.
do.	....	Nov. 16, 1906	....	.....	Approves that copies of orders in Council Nos. 668 and 669 be furnished to solicitors.
do.	....	Sept. 22, 1908	Sept. 24, 1908	3581	Approves revised schedule of rates.
do.	....	May 11, 1909	....	.....	Approves extension of works.
Ymir Water Works Co. [Inc. May 25, 1898].	....	Dec. 19, 1898	....	.....	Approves record 100 inches.

PORTION OF TOBY CREEK

Typical of many deeply eroded streams tributary to upper Columbia river.



TYPICAL VIEW OF COLUMBIA RIVER ABOVE REVELSTOKE

River here is navigable by steamer to Laporte, below Priest rapids.

Rules, Regulations and Fees under the Water Act

The Government of British Columbia at different times has established schedules of fees for water records and licenses, but, for one reason or another, officials have not uniformly or systematically enforced collection. Doubtless the chief difficulty has been due to the lack of data respecting the ownership and status of old records and resultant confusion arising out of this difficulty will readily be understood where there is an appreciation of the bearing of various uncertainties already explained as attaching to many of the early water records.

Another phase of this problem is the contention of some of the larger and stronger corporations—such as water-power companies—either that they are not liable, or only partially liable, for back fees.* These contentions, sometimes involving decision by the courts, have made it difficult for the provincial authorities to act as promptly as they wished. Their desire is not to accord to large water users a consideration not equally extended to the small, but to deal fairly with all interests.

Again, in anticipation of adjudication upon the validity of each provincial water record, and the quantity of water entitled to be diverted thereunder, the Province has been unwilling further to complicate the matter of rentals, and has endeavoured to avoid compromising its contentions respecting old records by accepting fees except under certain prescribed conditions. Thus, in 1910, water recorders were instructed by Chief Water Commissioner Drewry not to accept rentals on old records where the water had not been placed to use. In 1913, however, these instructions were modified by a circular letter from Acting-Comptroller of Water Rights Armstrong, to the effect that rental payments on records should be accepted, but that the parties should be notified that there would be no refund on such payments. Naturally, water users tendering payment would contend that the Government, by accepting same, had virtually sanctioned their claim under the respective records.

In 1913, referring generally to this earlier condition of affairs, Mr. C. A. Pope, Chief Clerk to the Waters Branch, stated :

"Up to the present season the collection of rentals on water rights had never been undertaken in a systematic manner, each recorder keeping a register of payments made to him in any manner he saw fit. The result was that no two officers kept the same records, and it has been found that in some cases no register of any sort was kept, payments merely being brought to account and noted on the face of the record."

Many fees due the Province have never been collected and are still considered to be outstanding. More especially since 1913, procedure respecting the collection of fees has been systematized. However, conditions respecting the back dues have not been cleared up.

As the various fee schedules are of special interest in connection with issues involving their recognition, they are reviewed below :

The Water Clauses Consolidation Act of 1897 provided that:

* Consult sec. 290 of Water Act, 1914.

"The Lieutenant-Governor in council may, from time to time, by order in council, establish a scale of fees payable on any proceeding taken under this Act, and provide regulations for the payment and collection thereof. Every such scale of fees shall be published for one month in the *British Columbia Gazette*."*

Pursuant to this provision, the Lieut.-Governor in council, on October 16th, 1900, published the following schedule of fees :

FEES UNDER WATER ACT, 1897

Schedule One

Records of Water for Domestic, Agricultural, Industrial and Mining Purposes—

For every record or interim record of 100 inches of water or less	$10.00
For every additional 100 inches up to 300 inches	20 00
For every additional 100 inches above 300 inches up to 2,000 inches	30.00
For every additional 1,000 inches above the first 2,000 inches up to 12,000 inches	40.00
For every additional 1,000 inches up to 100,000 inches †	20.00
For apportioning the water authorized to be used under any record	5.00
In respect of every record or interim record (except in respect of water recorded and actually used for agricultural purposes) an annual fee up to the first 300 inches of	5.00
For every additional 100 inches up to 2,000 inches, an annual fee of	3.00
For every additional 1,000 inches up to 12,000 inches, an annual fee of	25.00
For every additional 1,000 inches up to 100,000 inches †	20.00
Inspection or search of any record in any record of water rights	.25
Filing any notice or document with a Commissioner or Gold Commissioner	.50
For certified copies of any record or document per folio of 100 words	.25
Publication in the *Gazette* according to the scale of charges as defined in Schedule A of the 'Statutes and Journals Act'	
Annual fees to be paid to the Commissioner for the district on or before the 30th day of June in each year	

Schedule Two

The Supplying of Water by Water-works Systems to Cities, Towns, and Incorporated Localities—

Every municipality or specially incorporated company shall pay in respect of each of the several matters in Schedule One of this scale the fees in respect of such matter by the said Schedule One prescribed :

For the presenting by a specially incorporated company of a petition under sec. 53 of the Act and the filing of the documents by sec. 52 prescribed, a fee of	$25.00
For every certificate issued under sec. 55 of the Act, a fee (to be paid to and for the use of the judge of the Supreme Court granting such petition) of	100.00

* See chapter 45, sec. 151, of 1897 ; also *British Columbia Gazette*, October 19, 1900, p. 1708.

† By order in council No. 202, dated April 8, 1905, and published in the *British Columbia Gazette*, April 13, 1905, p. 694, the above schedule was amended by striking out the words 'up to 100,000 inches' in the two places in which they occur.

Schedule Three

The Acquisition of Water and Water Power for Industrial or Manufacturing Purposes by Power Companies—

Every power company shall pay in respect of each of the several matters in Schedule One of this scale the fees in respect of such matter by the said Schedule One prescribed :

For the filing of the documents mentioned in sec. 85 of the Act, a fee of	$ 25.00
For every certificate under sec. 88 or sec. 90 of the Act, a fee of	100.00
For the examination and approval of every schedule or proceeding fixing tolls, rates, fares, rents or charges, a fee of	10.00

Later, under the Water Act, 1909, respecting rents, etc., it is provided that :

"The Lieutenant-Governor in council may, from time to time, by order in Council, reserve and fix such rents, royalties, tolls and charges in respect of the water used or taken and used, and of the lands of the Crown used, and of the rights, powers and privileges which may be acquired by any licensee under this Act." *

On May 12, 1910, the Lieutenant-Governor, under the provisions of the Water Act, 1909, published a new schedule of fees, as follows :

FEES UNDER WATER ACT, 1909

Number of cubic feet per second—	*Record fee*	*Annual fee*
Up to one cubic foot	$10.00	$1.00
Each additional cubic foot up to a total of 50	10.00	1.00
Each additional cubic foot up to a total of 150	2.50	1.00
Each additional cubic foot	1.00	1.00

There shall be no annual fee for water used for domestic purposes when the quantity taken is less than one-quarter of one cubic foot per second.

Application under sec. 86	$ 25.00
Certificate under sec. 89 or 92	100.00
Amendment under sec. 93	25.00
Application and license under sec. 151	25.00
Application and license under secs. 159 and 163	100.00
Examination and approval of any schedule of tolls, rates, fares, rents and charges	25.00

0·028 cubic foot per second = one miner's inch.

The record fee shall be payable before the issuance of license. Annual rental for the unexpired portion of the current license year shall be paid before the issuance of license, and shall be determined proportionately by the number of months to the succeeding first day of June, including the month of issue.

Annual rentals shall thereafter be payable on the first day of June in each year.

Licenses which have been applied for under the Water Act, 1909, but have not yet issued, shall be issued in order of filed applications, if approved, the annual rental running from the date of issuance.

* See chapter 48, 1909, secs. 306-310, incl.; also *British Columbia Gazette*, May 12, 1910, p. 3821.

The 'Water Act, 1914,' in sec. 66, sub-sec. 1, provides that :

"The Lieutenant-Governor in council may, from time to time, by order in council, reserve and fix such rents, royalties, tolls, and charges in respect of the waters used or taken and of the lands of the Crown used and of the rights, powers, and privileges acquired by any licensee under this Act, and may establish a scale of fees payable on any proceeding under the Act."

And under sec. 68, sub-sec. 1, it is further provided that :

"The Lieutenant-Governor in council may, from time to time, make, alter, and repeal rules and regulations for carrying out the spirit, intent, meaning, and purpose of this Act, including matters in respect whereof no express or only partial or imperfect provision has been made, and without restricting the generality of the foregoing in respect of . . .

(*f*) The collection of rents, royalties, tolls, fees, and other charges due to the Crown."

Although the present Rules and Regulations were framed and published before the 'Water Act, 1914,' was enacted, the Rules were made effective by sec. 68 (2) of the 'Water Act, 1914,' which provides that :

"The 'rules' under the 'Water Act,' passed by the Lieutenant-Governor in council on the thirteenth day of January, 1914, and published in the *British Columbia Gazette* of the twelfth day of February, 1914, shall, so far as they are not inconsistent with the Act, be the 'rules' under this Act until altered or repealed by the Lieutenant-Governor in council."

The fee schedule of May 12, 1910, was of force until superseded by these Rules, Regulations and Fees of January 13, 1914.*

An examination of the principles underlying the water legislation of British Columbia demonstrates that these same principles have been extended to the Rules and Regulations.

In making these 'Rules' operative, the provincial authorities have endeavoured to give every encouragement to legitimate development and to discourage all purely speculative activity. They accordingly leaned to the side of severity with respect to demands upon the applicant during the period prior to the actual consummation of an undertaking. This action is based upon the belief that such restrictions as may be imposed will not deter any *bona fide* party from pressing ahead with development. On the other hand, parties who are simply desirous of securing only such benefits as may be obtained from a project while in its promotion or initial stages, will probably be deterred from making such efforts. In pursuance of this object, the fees payable for respective water-power sites have been so apportioned as to be as nearly proportionate as possible to the intrinsic values inherent in and derivable from the use of the water. Thus the Rules provide that : "In appraising the franchise value of a horse-power of station output the Board shall consider the natural advantages of the site for the production and market-

*See reference to 'Rules, Regulations and Fees,' in Chapter III, *supra*, including reference to dates, *ibid*.

ing of power in comparison" with that of fuel plants—or other water-power plants in the province, and shall compare the cost of producing and marketing power by the use of the water-power plant under consideration with that of producing and marketing power by the use of fuel plants—or "other water-power plants"* (clause 66). In the main, the province takes the position that essentially it is a vendor of water, or the rights to the use of the water, and is not directly concerned with the detailed manner in which the benefits derived from the use of the water are subsequently utilized.

Again, payments to be made during 'the survey construction period' are made heavier than might be anticipated, but, as an evidence of good faith, the province stipulates that, after completion of the undertaking, all rentals which have been paid during *the survey construction period* are rebated to the licensee in the form of credits upon his rental account during 'the operation period.' It is avowedly the desire of the province in every possible way to protect and assist applicants who desire to place water to beneficial use.

We may now proceed to consider in greater detail the present Rules, and more particularly such portions as relate specifically to water-power.

In the Rules, the references given to the various sections are to the 'Water Act,' as consolidated in the Revised Statutes of 1911, with amendments to date. Footnote references, however, are here given to the corresponding numbers of sections in the Water Act, 1914.

The Interpretation section of the 'Rules' states that :

"2. In the construction of these regulations, including this clause, if not inconsistent with the context, the following terms shall have the respective meanings herein assigned to them :

"*Act* means the Water Act of British Columbia and any Act passed by way of amendment or consolidation thereof or in substitution therefor :

"*Permit* means the permit to make surveys granted to an applicant for a license under the Act :

"*Survey-construction period* means that time during the pendency of an application for a final license which occurs between the date of the permit and the date when beneficial use of the water under the conditional license is first made :

"*Operation period* means the time during the continuance of the license after the date when beneficial use is first made as aforesaid :

"*Due notice* means notice by registered letter of [to] the address given in the application or of [to] any amendments of the said address on file in the office of the Water Rights Branch.

"Any other words used in these regulations which have an interpretation given them by section 2 of the Act shall have the same meaning in these regulations."

The "Rules" consist of seven parts, each of which is referred to below :

*For a discussion of methods recommended for adoption in securing information necessary under the Water Act Regulations for the appraisal and classification of water-power plants, consult *Paper No. 380*, being the 'Rules and Regulations of the Province of British Columbia Relating to Annual Rental Fees of Water-Powers,' by Mr. E. Davis, *Transactions, Canadian Society of Civil Engineers*, Vol. XXX, Part I. pp. 166-196.

PART I, consisting of clauses 4 to 21, deals with procedure and fees on petitions and certificates under secs. 89, 93, 97, 119, 120, 153, 154, 161, 170, 179, 284, 285, 288A, 288B, 312 and 329.*

Clauses 5 to 20 relate to procedure respecting the filing, serving and advertising of petitions ; to objections and the duties of the Comptroller relating thereto ; to the signing of plans submitted ; to the submission to the proper authorities of plans affecting highways and other public works ; and to the recording of certificates and orders in council, etc., with the Water Recorders in each district affected.

Clause 21 provides that the following fees shall be payable in respect of certificates and petitions :

Petition under sec. 89 (approval of undertaking.)	$ 25.00
Certificate under sec. 93 (approval of undertaking)	100.00
Petition and certificate under sec. 95 (amending certificate)	25.00
Petition under sec. 97 (extension of time)	25.00
Petition under sec. 120 (expropriation by municipality)	5.00
Petition under secs. 153 and 154 (clearing streams for logging)	25.00
Petition under sec. 161 (same, application for final license)—No fee.	
Petition under sec. 170 (extension of time)	10.00
Petition under sec. 179 (assignment under Part XI.)	10.00
Petition or order under secs. 284 and 285 (transfer of municipality or power undertaking)	10.00
Submission of schedule of tolls by company under sec. 312—No fee.	
Petition under sec. 329 (information by injured party)—No fee.	
All other petitions, charge in the discretion of the Minister.	

Corresponding numbers of sections in the Water Act, 1914, are shown in footnote.

PART II, consisting of clauses 22 to 34, deals with the expropriation of water licenses by municipalities under sec. 119 of the Water Act.†

PART III, consisting of clauses 35 to 41, deals with the conditions upon which a licensee, a record holder, or an applicant for a license under the Water Act, shall take possession of, use or occupy any Crown lands, or fell timber thereon for rights-of-way and other purposes. Respecting the applicant for such privileges, clause 39 states that :

"He shall have agreed to pay to the Crown in the right of the Province for the use of the said right-of-way the sum of 25 cents per acre per annum, and shall have agreed to pay to the Crown in the right of the Province for such timber as he may cut or carry away from the said right-of-way the sum of $2 per 1,000 feet, board measure."

* Corresponding sections in the Water Act, 1914, are here shown in italics :

89 [1913, c. 82, s. 49] relates to petition for approval of undertaking, see *79*. 93 relates to certificate of approval of undertaking, see *81* ; 97 [1913, c. 82, s. 55] relates to extension of time for construction of works, see *83* ; 119 and 120 relate to expropriation of recorded water by municipalities, see *138 (1)* and *139 (1)* ; 153 and 154 relate to petitions for the clearing of streams for logging purposes, compare *70 (3), 73, 75* ; 161 relates to final license for clearing streams and is *embodied in Part V* ; 170 relates to petitions for extensions of time and comprises applications for clearing streams, compare *72 (3), 75 (2), 88,* and *117 (2)* ; 179 relates to assignments under Part XI, see *14 (1)* ; 284 and 285 relate to transfer of municipality or company undertakings, see *14 (2), (1)* ; 288A and 288B [1912, c. 49, s. 53 ; 1913, c. 82, ss. 2, 83] relate to petitions requesting the inspection of works, see *61* ; 312 relates to the submission of schedule of tolls by company, see *159* ; 329 relates to the petition for relief by injured party, see *61 (1)* ; 95 (mentioned in clause 21 of Rules) relates to the issuance of further or amending certificates, see *83*.

† Corresponding to sec. 138 of Water Act, 1914.

Those who have noted the reference, made above, to the desire of the provincial authorities to differentiate between the respective values of various water-powers, will perceive that a uniform charge of twenty-five cents per acre for the use of the right-of-way to Crown lands is not consistent—obviously, in some instances, twenty-five cents per acre may be too high, in others, too low. For example, extensive areas used near the headwaters of streams, say, for storage purposes, may be worth considerably under twenty-five cents per acre, whereas this rate for right-of-way in certain settled districts would be ridiculously low. In the practical working out of the Rules, however, modifications will doubtless be made as occasion demands.

Part IV, consisting of clauses 42 to 53, deals with fees for the use of water for domestic, irrigation, industrial, mining and other purposes where the production of power is not involved.

Part V, consisting of clauses 54 to 68, deals with fees for the use of water in the development of power. Sections 55 to 68 are as follows :

Record Fee and Bond

"55. A record fee shall be payable within fifty days from the first publication in a local newspaper of the notice of intention to apply for a license. (This date is fixed by section 61 of the Act.)

"56. The said record fee shall be based upon the net amount of energy, expressed in horse-power, which can be developed at the site from the amount of the flow of water applied for. For the purpose of this tariff, the said horse-power shall be determined as the continued product of the following factors :

"(a) The amount of the flow of the water applied for expressed in cubic feet per second :

"(b) The average available static head in feet. (Unless surveys have established the said head, the Comptroller shall make an estimate of the same from such data as are available, and this estimate shall be used hereunder ; provided that after surveys have established the said head, the record fee shall be readjusted in accordance therewith, and any excess or deficiency of the payment made on account thereof shall be deducted from or added to the next subsequent payment falling due under the application) :

"(c) The factor 0·08 (which represents the horse-power produced by one cubic foot of water falling through one foot in one second at 70 per cent efficiency).

"57. The amount of the said record fee per horse-power shall be as follows :

Each horse-power up to 1,000	$0.50
Each additional horse-power up to 5,000	.25
Each additional horse-power above 5,000	.10

"58. At the time of the granting of a permit the Comptroller shall require the execution by the applicant of a good and sufficient bond, guaranteeing the performance in good faith, and to the satisfaction of the Comptroller and the Minister, of the things required to be done by him under the terms of the permit and of the Act during the survey-construction period. The amount of this bond shall be not less than five times the amount of the record fee.

Survey-construction Period

"59. An annual rental fee shall be paid during the survey-construction period, its amount to be based on the same principle and computed in the same

manner as the record fee (clauses 56 and 57, above) : Provided that where the requisite data contained in the application are varied in the permit the computation shall be based on the latter.

"60. The first payment of fees to apply on rental during the survey-construction period, known as the permit-payment, shall be payable on the day when the permit is issued, and shall cover the rental for a year from the said date. The second rental payment shall be payable on or before the first day of June in the first full calendar year of the said period and shall cover that part of the said calendar year not covered by the first payment. Subsequent rental payments shall be payable on or before the first day of June of each year thereafter, and shall cover the fee for the calendar year respectively in which they are made.

"61. All payments made on account of rental during the survey-construction period (but not the record fee) may, if in the opinion of the Comptroller the survey and construction work has been prosecuted with due diligence, be credited to the licensee for the cancellation of charges as they become due in the operation period.

"62. If any part of the amounts due for fees as set forth in clauses 6 and 7 hereof shall, after due notice has been given, be in arrears for sixty days, then and thereupon :

"(a) If the applicant is holding under a permit, the Comptroller may cancel the said permit ; or

"(b) If the applicant is holding under a conditional license, the Lieutenant-Governor in Council may, on the recommendation of the Minister, direct the Comptroller to cancel the said conditional license.

Operation Period

"63. The amount of the annual rental fee shall, during the operation period, be based on the reasonable station output for the year, which shall be the Comptroller's estimate of the net amount of energy, expressed in horse-power, available for transmission and utilization during the year by a reasonable and diligent use of the privilege. The said estimate shall be based on all data available for the preceding calendar year, and shall be the continued product of the following factors as derived from the said data :

"(a) The average flow of water in cubic feet per second which it is estimated was or would have been utilized under a reasonable use of the privilege granted. In fixing the said flow, the Comptroller may make use of all data in the possession of the licensee showing the actual quantity of water used for beneficial purposes during the year ; and

"(1) If he considers the said use as determined from the said data a reasonable one under all the circumstances, the quantity so used may be taken as a basis of the charge ; or

"(2) He may fix the quantity at such percentage of the average flow estimated to have been available at the intake as in his opinion represents a reasonable use of the privilege. In estimating this average available flow at the intake, the effect produced by storage in any and all existing storage-works at or above the site shall be taken into account. In fixing a reasonable percentage of this flow, the Comptroller shall consider the average daily-load factor of the power plant for the period of the year during which the works are operated, and any other facts relevant to the inquiry :

"(b) The average effective head in feet :

"(c) The factor 0·08 (which represents the horse-power produced by one cubic foot of water falling through one foot in one second at 70 per cent efficiency).

Concrete lined ditch.

Wooden flume skirting mountain side.

TYPES OF SMALL POWER AND IRRIGATION STRUCTURES

"64. The amount of the said annual rental fee per horse-power shall be fixed by the Board as hereinafter directed: Provided, that in no case shall the said fee be less than 25 cents nor more than $1 per horse-power per annum.

"65. The Board shall, at least once every five years, appraise the franchise value of a horse-power of station output at each water-power plant operating under a license in the Province, and shall, upon the basis of the said appraisal, classify the said plants into not less than two or more than five groups, and shall, within the limits prescribed by clause 64 hereof, fix the said annual rental fee per horse-power for the plants in each group, and payments shall be made in accordance therewith: Provided, that until the first appraisal of the output of any plant and its classification hereunder are completed, the Board may, within the limits prescribed in the said clause 64, set an arbitrary rental fee per horse-power on the station output of the said plant, and payment shall be made by the licensee in accordance therewith; but any excess or deficiency in such payment over or under the fee as later determined from the said appraisal and classification shall, *pro tanto*, be deducted from or added to the next subsequent payment due from the said licensee after the said appraisal and classification are completed.

"66. In appraising the franchise value of a horse-power of station output the Board shall consider the natural advantages of the site for the production and marketing of power in comparison with that of fuel- or other water-power plants in the province, and shall compare the cost of producing and marketing power by the use of the water-power plant under consideration with that of producing and marketing power by the use of fuel- or other water-power plants. To this end account shall be taken in either case of

"(*a*) Interest on the fixed charges, which shall include the cost of an entire plant and works:

"(*b*) Maintenance and depreciation:

"(*c*) Labour and administration at the works:

"(*d*) Loss caused by irregularity of stream-flow and necessity of supplementing the water-power by steam or other form of power:

"(*e*) Cost of fuel:

"(*f*) Length of primary transmission:

"(*g*) The market for power:

"(*h*) Any other factors relevant to the inquiry.

"67. The first payment of fees to apply on rental during the operation period shall be payable on the first day of June in the first full calendar year of the said period, and shall cover the rental for the said calendar year and for such part of the preceding calendar year as falls within the said period. Subsequent rental payments shall be payable annually thereafter, and shall each cover the fee for the calendar year respectively in which they are made.

"68. If any of the amounts due for the said fees shall, after due notice has been given, be in arrears for more than one year, then and thereupon the Lieutenant-Governor in council may, on the recommendation of the Minister, direct the Comptroller to cancel the conditional or final license, as the case may be."

PART VI, consisting of clauses 69 to 73, deals with the necessity of licensee maintaining suitable head gates, structures and measuring devices. The clauses of this portion of the Rules have been incorporated in the Water Act, 1914.*

PART VII, consisting of clauses 74 to 79, deals with the filing of plans, office procedure and fees. Several of the clauses of this part have been embodied in Part V of the Water Act, 1914.

* Thus clauses 69, 70, 71, 72 and 73 of the Rules correspond, respectively, to sections 34, 124, 35, 65 and 157 of the Water Act, 1914.

The office fees chargeable for clerical work are enumerated in clause 79, as follows :

Certified copies of any record or document, per folio of 100 words	$0.25
Blue-prints, 5 cents per square foot, with minimum charge of	0.25
Inspection of [or] search of any record, license, or other document	0.25
Apportionment of a license :	
If apportioned into five parts or less	5.00
For each additional part	0.50
Change of point of diversion	1.00
Renewal of record or license under section 255, one-quarter of record fee.	
Transfer of a license under section 285	10.00

Certain details of the Rules and Regulations yet require to be co-ordinated to the present Water Act. These Rules of 1913 are still (1917) of force, but modifications have been under discussion, and it is understood that, in the near future, changes will be made which will facilitate an effective and forceful administration of the Rules as complementary to the main water legislation of the province—a function for which they were expressly devised. Application should be made to the Water Rights Branch, Victoria, B.C., for a copy of the latest edition of the Rules.

With respect to the new fee and rental system, now in operation, Mr. C. A. Pope has stated that loose-leaf registers are now prepared in duplicate for each district, and these have been brought up and are kept up to date.

The revenue for the year 1916 is classified under the following headings, and is representative of the manner in which the revenue is derived from the various spheres of activity. The total revenue from June 1st, 1910, to December 31st, 1916, was approximately $275,000.*

REVENUE FOR YEAR ENDING DECEMBER 31st, 1916

Purposes	Record fees	Rentals	Totals
1. Domestic	$ 114.00	$ 108.50	$ 222.50
2. Water-works	243.00	867.45	1,110.45
3. Mineral-trading	......	......	......
4. Irrigation	825.70	2,469.17	3,294.87
5. Mining	952.00	6,437.98	7,389 98
6. Steam	1.00	369.41	370 41
7. Fluming	25.00	55.75	80.75
8. Hydraulicking	......	......	......
9. Miscellaneous	264.50	1,225.42	1,489.92
10. Power	1,567.50	45,590.07	47,157.57
11. Clearing streams	......	175.00	175.00
12. Storage	95.55	822.60	918.15
13. Conveying	......	......	......
14. Lowering water	5.00	......	5.00
15. Certificates of approval	1,250.00	......	1,250.00
Totals	$5,343.25	$58,121.35	$63,464.60

* The totals for record fees and rentals since the establishment of the Water Rights Branch have been as follows : For the year ending June 1st, 1910, $4,057 ; June 1st, 1911, $49,591 ; June 1st, 1912, $29,849 ; June 1st, 1913, $37,795 ; June 1st, 1914, $42,005 ; June 1st to December 31st, 1914 (7 months), $18,196 ; calendar year, 1915 $28,116 ; calendar year 1916, $63,465 ; calendar year 1917, $27,566.

CHAPTER V

Electrical Inspection by Province of British Columbia

TABLE OF POWER PLANTS

As the development of electrical energy in British Columbia increased and accidents arising from its use multiplied, it was evident that steps should be taken to protect the public more adequately from such accidents; and, also, that the companies should be protected from unjust claims made by injured parties. Several of the larger companies also felt that they should be protected from pressure being put upon them by such municipalities as might desire to impose restrictions upon operation which would possibly prove unnecessarily onerous.

The whole question was made the subject of special conference between Attorney-General W. J. Bowser and the larger provincial electrical companies. It was agreed, contingent upon the enactment of suitable legislation and the appointment of an inspector of electrical energy, that the companies would co-operate in a unified system of inspection, and that the cost incident to the office of an official inspector would be apportioned on a *pro rata* basis between the various companies operating in the province.

On March 10, 1910, 'An Act to Provide for the Inspection of Premises, Works, Wires and Appliances Generating, Transmitting, or Supplying Electrical Energy' was passed. It is known under the short title of the 'Electrical Energy Inspection Act, 1910.' This measure (secs. 2 and 3) provides that:

"The Lieutenant-Governor in Council may appoint and authorize any proper person (hereinafter called 'the Inspector'), whose duty it shall be, and who shall have authority, at all reasonable times:

(*a*) To enter upon any place, building, or structure, and inspect all machinery, plant, works, wires, and appliances used for or in connection with the generation, transmission, or supply of electrical energy for power, lighting, heating, or telephonic or telegraphic communication purposes:

(*b*) To require the attendance of all such persons as he thinks fit to summon and examine, and to require answers or returns to be made to such inquiries as he thinks fit to make:

(*c*) To require the production of all books, papers, plans, specifications, drawings, or documents material for the purpose of such inspection.

"The authority of the inspector shall be sufficiently evidenced by a paper in writing, signed by the Provincial Secretary, stating that the person named therein has been appointed an inspector under the provisions of this Act."*

The Act further provides that:

* Mr. D. P. Roberts, of Vancouver, was appointed inspector by Order-in-Council No. 736, September 24, 1910.

"Every person, and the officers, servants, employees, and agents of every person, whose premises, machinery, plant, works, wires, or appliances are being inspected under the provisions of this Act, shall afford to such inspector all information, and full and true explanations, so far as may be in their power or knowledge, on all matters inquired into by such inspector, and shall produce and submit to the inspector all books, papers, plans, specifications, drawings, and documents material for the purpose of the inspection being made."

The inspector is to be furnished with all means required for his entry, inspection, examination and enquiry. A penalty is provided for any obstruction offered him in the discharge of his duties. The inspector formerly reported to the Attorney-General, but under the 'Electrical Energy Inspection Act Amendment Act, 1917', he now reports to the Minister of Public Works.*

When the inspector is of the opinion that any structure, or any machinery, plant, works, wires, or appliances used in connection with the generation, transmission, or supply of electrical energy is dangerous to life or limb, he may notify the owner thereof to remedy such defect within a specified time. Procedure is set forth respecting the exacting of penalty for non-compliance with an order of the inspector.

It is expressly stipulated that inspection under this Act does not in any way relieve any person of or from any liability or responsibility resting upon such person by law. (See Sec. 17.)

Under the Act the Lieut.-Governor in council may, from time to time, make such regulations for enforcing its provisions and for the conduct and the duties of the inspector as may be deemed necessary. In accordance with this provision, regulations, by order in council of May 2, 1911, were adopted for 'Securing the Safety of the Public.'† They expressly define the significance of various terms, such as 'low-pressure,' 'high-pressure,' 'conductor,' 'apparatus,' 'circuit,' etc., used in the Regulations. The term 'danger' is defined as meaning "danger to health or danger to life or limb, from shock, burn, or or other injury to persons employed, or from fire attendant upon the generation, transformation, distribution, or use of electrical energy."

The inspector, if satisfied that safety is otherwise practically secure, or that exemption is necessary on the ground of emergency or special circumstances, may grant an exemption from the operation of any or all of the regulations and may revoke such order.

The Regulations specifically prescribe certain forms and modes of construction which shall govern the installation of various electrical equipment.

Respecting the employment and protection of help, secs. 28 and 29 of Regulations specify that :

"No person except an authorized person, or a competent person acting under his immediate supervision, shall undertake any work where technical knowledge or experience is required in order adequately to avoid danger ; and no person shall work alone in any case in which the Inspector of Electrical Energy directs that he shall not. No person except an authorized person, or

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* See 'An Act to Amend the Electrical Inspection Act,' assented to April 5, 1917, *British Columbia Statutes*, 1917, chap. 24.

† The Regulations consist of 32 sections. Published by the Electrical Energy Inspection Branch, Dept. of Public Works, Victoria, B.C.

a competent person over twenty-one years of age acting under his immediate supervision, shall undertake any repair, alteration, extension, cleaning, or such work where technical knowledge or experience is required in order to avoid danger, and no one shall do such work unaccompanied.

"Where a contractor is employed and the danger to be avoided is under his control, the contractor shall appoint the authorized person; but if the danger to be avoided is under the control of the occupier, the occupier shall appoint the authorized person.

"Instruction as to the treatment of persons suffering from electric shock shall be affixed in all premises where electrical energy is generated, transformed, or used above low pressure; and in such premises, or classes of premises, in which electrical energy is generated, transformed, or used at low pressure, as the Inspector of Electrical Energy may direct."

The following is a list of the principal equipment of power developments in the province which come within the jurisdiction of the Electrical Energy Inspection Act and of the Regulations complementary thereto.*

* This list does not include a number of mining plants with prime movers—usually Pelton wheels—for driving pumps, mills, air compressors, etc., and sometimes small lighting generators. The aggregate installed capacity of these is estimated at from 7,000 to 10,000 h.p., the installation being usually in excess of the low-water flow. Particulars of many of these plants are given in the Power Site tables.

POWER PLANTS IN BRITISH COLUMBIA

Municipality or company and situation of plant	Prime Movers: Water,-W; steam,-S; gas,-G; oil,-O — Kind	No. of units	H.p. of each	Total horse-power installed	Generators: Alternating current,-A.C.; direct current,-D.C.; exciters,-E — Kind	No. of units	K.w. of each	Voltage	Total kilowatt capacity of plant	High tension transmission voltage	Remarks
Adams River Lumber Co., Ltd.; Chase.					A.C.	1	120	1,100			Robb Armstrong engine belted to General Elec. Co. Alternator.
	S	2	80		A.C.	1	60	1,100			Houston, Stanwood and Gamble engine belted to United Elec. Co. Alternator.
					E.	1	1¼	110			General Elec. Co. exciter belted to engine.
	S	1	5	165	E.	1	3	110	180	1,100	Exciter direct connected to 5 h.p. engine. Fuel,—shavings. Two complete units, but only one used at a time. Operates 18 hours per day in winter, 10 hours in summer.
Port Alberni city: Vancouver Island	O	1	150	150	A.C.	1	100†	2,200	100†	2,200	Aktiebolaget Diesels Motorer (Stockholm, Sweden), 3 cylinder. Operates 18 hrs. per day in winter, 10 in summer. Plant also supplies city of Alberni.
Anglesey Estates: Walhachin.	O	1	15	15	D.C.	1	10	110			Service voltage, 110. Plant out of commission, probably will not be used again in the near future.
Armstrong City: Development on Fortunes creek, 3m. east of city.	W	1	150		A.C.	1	100	2,300			Pelton, direct coupled to generator, 550 ft. head.
	O	1	200	350	A.C.	1	120	2,300	220	2,200	Diesel engine set; auxiliary for low water periods.
Ashcroft Water, Electric and Improvement Co.: Development on Bonaparte river, 4m. from Ashcroft	W	1	150		A.C.	1	75	2,200	75	2,200	One turbine belted to alternator; also 750 h.p. for irrigation pumping; 45 ft. head. Dam washed out in 1913, not yet (1918) replaced.
	W	1	750	900							
Oil Engine Auxiliary plant at Ashcroft	O	1	50		A.C.			2,300			Light and power for pumping domestic supply now obtained from oil engines.
	O	2	20	90							
Britannia Mining and Smelting Co.: Britannia Beach, Howe sound: Development of Britannia creek*	W[1]	1	330		A.C.	1	200	6,600			Pelton-Doble, 900 r.p.m., direct connected to alternator, 3 phase, 60 cycle.
					E.	1	6¼	125			Exciter belted to above.
	W[1]	1	130		A.C.	1	100	6,600			Pelton-Doble, 900 r.p.m., direct connected to alternator, 3 phase, 60 cycle.
					E.	1	6¼	125			Exciter belted to above.
	W[1]	1	125								Pelton-Doble, 330 r.p.m., belted to Rand compressor, 120 r.p.m., capacity 700 cu. ft. per min.
Tunnel Power House, 3m. from beach,—Elevation 2,083 ft.	W[1]	1	200								Henry wheel, 480 r.p.m., belted to Rand compressor, 180 r.p.m., capacity 1,100 cu. ft. per min.
	W[2]	1	1,400		D.C.	1	300	600			Pelton, 900 r.p.m., direct connected to motor-generator set. Motor, 550 k.v.a., 6,600 volts, 3-phase, 60-cycle.
					E.	1	15	125			Exciter in connection with above.
	W[2]	1	550	2,735					600	6,600	Pelton, 160 r.p.m., direct connected to Rand Rogler compressor, capacity 3,600 cu. ft. per min.

	W[1]	2	330	......	A.C.	2	200	6,600	......	......	Peltons, 600 r.p.m., direct connected to Westinghouse generators, 3 phase, 60 cycle.
Beach Power House, —Elevation 165 ft.	W[2]	1	330		E. A.C.	2 1	17 200	250 6,600	......	......	Exciters belted to above.
	W[4]	1	220	......	E. D.C.	1 1	6½ 150	125 250	......	......	Pelton, 900 r.p.m., direct connected to Allis-Chalmers generator, 3 phase, 60 cycle. Exciter belted to above.
	W[3]	2	3,750	...	A.C.	2	2,000	6,000	......	......	Pelton-Doble, direct connected to Crocker-Wheeler generator.
Beach Compressor House, —Elevation 5 ft.	W[4]	1	400	8,710 400	E.	2	18	125	4,750	6,600	Peltons, 720 r.p.m., direct connected to Westinghouse generators, 3 phase, 60 cycle. Exciters direct connected to above.
Old Concentrating Mill, —Elevation 50 ft.	W[5]	3	100	300	...	...	...	...	......	......	Pelton, 150 r.p.m., rope drive to Rand compressor 80 r.p.m., capacity 2,500 cu. ft. per min.
New Concentrating Mill, —Elevation 50 ft.	W[6]	2	250	300	......	...	...	...	......	......	Three Pelton wheels driving concentrators.
Steam Auxiliary, —Elevation 20 ft. Situated 100 feet from foreshore	S	1	650	......	A.C.	1	500	6,600	......	......	Two Pelton wheels, 360 r.p.m., driving oil flotation machines.
	S	1	3,300	3,950	A.C.	1	2,000	6,600	2,500	6,600	Turbine driving alternator, 3 phase, 60 cycle 3,600 r.p.m.
British Columbia Copper Corporation Steam plant at Princeton	S	1	650	650	A.C.	1	500†	460	500†	38,000	Turbine driving alternator, 3 phase, 60 cycle 3,600 r.p.m. Transmission line 13m. long to Copper mountain, installed 1911.
British Columbia Electric Railway Co. * (Vancouver Power Co.)											
Buntzen-Coquitlam Development, Burrard Inlet, Power House No. 1.	W W W	4 3 4	3,000 10,500	43,500	A.C. A.C. E.	4 3 4	1,500 5,000	2,200 2,200 ...	21,000	34,600	Development complete. H.t. transmission voltage may be increased to 60,000. Head, 400 ft. Exciters are each driven by water wheel and have also induction motor.
Buntzen-Coquitlam Development, Burrard Inlet, Power House No. 2	W W	3 3	13,500	40,500	A.C. E.	3 3	3,900 300	2,200	26,700	34,000	Development complete. Exciters are driven by Pelton wheels and induction motors.
Steam Auxiliary plant, Main st., Vancouver.	S S	4 1	....	18,000	A.C. A.C.	4 1	2,000 4,500	2,300 2,300	12,500	.....	Allis-Chalmers turbines driving alternators, 3 phase, 60 cycle.
British Columbia Electric Railway Co.: * (Vancouver Island Power Co.).											
Development at Esquimalt Water Works, Goldstream, —12m. from Victoria.	W W W	2 1 2	600 1,000 1,000	4,200	A.C. A.C. A.C.	2 1 1	350 500 1,000	700 700 700	2,200	17,500	Operation started Sept., 1898; third unit added 1903; fourth 1905. Two circuit single pole line to Bay Rock sub-station. Head, 650 ft. Storage in Esquimalt water works reservoirs. Development complete.
Development at Jordan River, —40m. from Victoria	W W W W	2 1 2 1	6,000 13,000 150 200	25,000	A.C. A.C. E. E.[7]	2 1 2 1	4,000 [illegible] 100 200	2,200 2,200 125 125	16,000	60,000	Pelton-Doble wheels regulated by Lombard oil pressure governors. Cedar pole transmission line, 37m. long, to Rock Bay sub-station. Two lines, aluminium, are installed. Head, 1,145 ft. Storage in extensive system of artificial reservoirs. Development to ultimate capacity of 38,000 h.p. will be completed by addition of one 13,000 h.p. unit.
Steam Auxiliary Plant, Brentwood bay, —12m. from Victoria.	S S	2 1	Turbines Exciter	......	A.C. D.C.[8] E. E.[10]	2 2 1 1	2,000 300 73 73	2,300 600 125 125	4,000	...	Steam auxiliary to Goldstream and Jordan river plants. Used at present only for emergencies. Plant designed for ultimate installation of four 5,000 k.w. units—20,000 k.w. in all. (For detailed description, see *Canadian Electrical News*, June 15, 1914.)

[1] Head 838 ft. [2] Head 1,464 ft. [3] Head 1,780 ft. [4] Head 625 ft. [5] Head 1,945 ft. [6] Head 695 ft. [7] These two exciters also coupled to two 150 h.p. induction motors. [8] This exciter is also coupled to a 300 h.p. induction motor. [9] Direct connected to and driven by one 1,500 h.p. synchronous motor. [10] Auxiliary exciter driven by 110 h.p. induction motor.

* For fuller description, consult chapter dealing with Power Developments in British Columbia. † k.v.a.

POWER PLANTS IN BRITISH COLUMBIA—*Continued*

Municipality or company and situation of plant	Prime Movers: Water,-W; steam,-S; gas,-G; oil,-O: Kind	No. of units	H.p. of each	Total horse-power installed	Generators: Alternating current,-A.C.; direct current,-D.C.; exciters,-E.: Kind	No. of units	K w. of each	Voltage	Total kilowatt capacity of plant	High tension transmission voltage	Remarks
Canadian Collieries (Dunsmuir) Ltd Development on Puntledge (Comox) river, 2m from mouth *	W	2	6,000	12,000	A.C.	2	3,500	13,200	7,000	13,200	Supplies mines, also towns of Cumberland, Bevan, Union Bay and Courtenay. 325 ft. head. Plant in operation since Sept., 1913. Ultimate development will double capacity. Present plant will carry maximum peak load of about 8,800 k.w.
Canadian Pacific Railway Hotel, Glacier Development on Illecillewaet river	W	2	50	100	D C	2	25	125	50	...	Small development for lighting hotel. Turbines, belt drive to generators; 60 ft. head; transmission line, 1,800 ft long.
Canadian Pacific Railway Co: Development at North Bend creek, 2,000 ft west of North Bend	W	1	9	..	D C	1	10	110			Available water being required for domestic supply, a 25 k w steam set is used most of the time. 200 ft. head developed.
	S	1	...	.	D C	1	25	110	35		
Canadian Pacific Railway, Hotel Vancouver	S	2		...	D C.	2	175	110		.	Two Robb-Armstrong vertical compound, direct connected to C G.E. generators. Three General Electric Co. Curtis turbo-generators. Three-wire system used.[1]
	S	3	Turbines	. .	D C	3	100	110 220	650	..	
Canadian Western Lumber Co Ltd: Fraser Mills	S	1		..	A C.	1	1,500	480			
	S	1		3,000	A C.	1	750	480	2,250	...	3 phase, 60 cycle generators.
Columbia River Lumber Co. Golden	S	1	1,200	...	A C.	1	1,000	480		.....	Allis-Chalmers steam turbine set; furnishes power to operate saw-mills, 24 hours per day for 195 days in summer.
	S	1	90	.	A.C	2	75	2,300	1,150	.....	
	S	1	60	1,350	...	...	...	...			
Cranbrook Electric Light Co. Ltd.:	S	1	400	.. .	A C	1	250	2,200		. ..	Goldie McCulloch engine direct-connected to Allis-Chalmers generator, 60 cycle, 2 phase.
	S	1	150	550	A C	1	75	2,200	325	....	Leonard engine, belt drive to Allis-Chalmers generator. Plant installed May, 1910.
Crows Nest Pass Coal Co: Plant at Michel	S	2	400	800	D C	2	250	250	500	. ..	
Crows Nest Pass Coal Co.: Plant at Coal Creek.	S	2	300	600	D.C	1	97	250	.		Continuous service. Installed 1902.
	....	.	..	......	D C	4	100	250	497		
Jno F. Decks Gravel Screening Plant Porteau, Howe sound.	W	1	125		...	.....	.....			...	Quarry and gravel screening plant. Peltons under 300 ft. head driving crushers and screens.
	W	1	75		...	.....	..		..	..	
	W	1	25		...	.....			.....		
	W	1	10	235	.....	.....		...	...	.....	
Denver Light and Power Co; New Denver: Development on Carpenter creek, 2m from lake.	W	1	55	55	A C	1	93†	2,400	. . 93†	2,200	94 ft. head developed, possible total head 350 ft. which when developed will make available about 1,000 h.p. Operates all year about 12 hours per day. Also supplies light to Silverton. Plant destroyed by fire July 20, 1914, and resumed operation Aug. 28, 1914.
Duncan Municipality: Plant in centre of city adjacent to Railway tracks.	O	2	100	200	A.C.	2	60	2,200	120	.. ..	Cole, Marchent & Morley Diesel engines, direct coupled to alternators.
	. .	.....	......	. .	E.	2	7	110	.. ..	.	Exciters direct coupled. Plant operates 24 hours per day in winter, 20 hours in summer.
Enderby: See Okanagan Sawmills.											

LOWER KETTLE VALLEY, NEAR GRAND FORKS, B.C.
This land is under cultivation by Doukhobors.

KETTLE RIVER, ABOVE GRAND FORKS, B.C.
Showing irrigation flume and railway. The proximity of railways frequently limits or prevents possible power development owing to damage by back flooding.

Fernie City: Steam Plant.	S	1	250	250	A.C.	1	150	2,400	300		66 cycle, 2 phase, operates continuously. Robb engine belted to generators.
Forest Mills of British Columbia Ltd.: Taft. Development on Crazy creek.	W	1	18		E.	1	12	125			Small Pelton. 7-inch wood-stave pipe. Power used in connection with sawmill. Steam auxiliary during winter months.
	S	1				1	12	120	12		
Fort Steele Mining and Smelting Co.: Marysville. Development on Mark creek, 1m above Kimberly.	W	3									Three 6-ft. Peltons. 180 ft. head developed. Plant owned by Consolidated Mining and Smelting Co.; supplies power to Sullivan mines; operates 17 hours per day.
Golden: See Columbia River Lumber Co.											
Granby Mining, Smelting and Power Co.: Grand Forks. Development on Granby (North Fork Kettle) river.	W	3	300		A.C.	3	180	440	540		Low pressure turbines direct connected. Power house about 40 miles from mouth of river; 30 ft. head developed by dam 40 ft. high.
	W	1	100		E.	1	22½	125			
	W	1	40	1,040							
Granby Consolidated Mining, Smelting and Power Co.: Anyox.[4]	W	4			A.C.	2a	938†	2,200	1,876†		a—Each unit driven by two water wheel runners overhung at either end of shaft. Two exciters, one driven by water wheel or induction motor, one by induction motor only.
					E.	2	50	125			
Development at Falls Creek, Granby Bay, Observatory inlet.[3]	W	3b	625								b—Three Pelton-Doble wheels operating Connersville positive blowers. Capacity of each 40,000 cu. ft. per min.
	W	1c	1,400								c—Pelton-Doble wheel, 23 ft. dia., driving blower for Bessimer converters.
	W	1d	800	about 6,600							d—Pelton-Doble wheel, 16 ft. dia., driving air compressor for general purposes. Head 385 ft.
Greenwood. City Water Works Co.: Development of Boundary Falls on Boundary creek.	W	1	150		A.C.	1	125	4,400			150 ft. head developed. Two Doble wheels. 60 ft. dam.
	W	1	15	165	E.	1	8	125	125	4,400	
J. Hanbury and Co., Lumber: Plant at Fourth Ave. and Granville st., Vancouver.	S	1	20		D.C.	1	10	120			Also one 250 h p. power feeder from B.C. Electric Railway Co.
	S	1	35		D.C.	1	12½	120			
	S	1	40		A.C.	1	500	480	522½		
	S	1	600	605							
Hedley Gold Mining Co.[4] Development on Hedley creek.	W	1	550		A.C.	1	400†	2,200	400		Head developed 412 ft. Pelton-Doble direct drive to generator. Steam auxiliary.
	S	1	500								
	W	1	Knight								Knight wheel driving Ingersol-Rand air compressor, 3,000 cu. ft. per min.
Development on Similkameen river, below Hedley creek.	W	1	2,100	2,100	A.C.	1	1,250†	6,600	1,250	6,600	Francis type turbine, direct coupled to alternator, with 25 k.w. direct connected exciter; 67 ft. head developed.
Kamloops City:[4] Development at Barriere river, 40m. north of city.	W	2	1,200	2,400	A.C.	2	750†	2,300	1,500†	44,000	Platt turbines, 600 r.p.m., direct connected to Westinghouse generators. Installed 1913. Space in power house for two additional units. Ultimate development about 20,000 h.p.; 190 ft. head developed.
					E.	2	75				
Steam plant in city.	S	1[2]	175		A.C.	1[2]	120	2,200			
	S	1[2]	350		A.C.	1[2]	200	2,200			
	S	2	1,200	2,400	A.C.	2	900	2,200	1,800		Two Curtis turbo-alternators, 3,600 r.p.m., with steam and motor driven exciters.
Kelowna City: Steam Plant, Water st., city.	S	1	200		A.C.	1	100†	2,300			Robb engine, Fairbanks generator.
	S	1	95		A.C.	1	50†	2,300			Goldie and McCulloch engine, Westinghouse generator.
	S	1	325	620	A.C.	1	250†	2,300	400†		Goldie and McCulloch engine, General Electric generator.

[1] See *Canadian Electrical News*, June 15, 1915, Vol 24, No. 12. [2] A steam auxiliary was built in 1916. Steam turbo-alternators of 2,500 k.v.a. 3,750 k.v.a., a 100 k.w. exciter and 800 h.p. compressor are provided. [3] Superseded.

[4] For fuller description, consult chapter dealing with Power Developments in British Columbia. † k.v.a.

POWER PLANTS IN BRITISH COLUMBIA—*Continued*

Municipality or company and situation of plant	Prime Movers: Water,-W; steam,-S; gas,-G; oil,-O — Kind	No. of units	H.p. of each	Total horse-power in-stalled	Generators: Alternating current,-A.C.; direct current,-D.C.; exciters,-E. — Kind	No. of units	K.w. of each	Volt-age	Total kilo-watt capacity of plant	High tension trans-mission voltage	Remarks
Kincolith Packing Co.: Development at Mill bay near mouth of Nass river.	W W	3 1	30 90	 180	......	......	......	......	......	......	Small Peltons driving canning machinery; 330 ft. head developed.
Kootenay Electric Co.: Kaslo Development on Kaslo river. 1½m. from mouth	W	1	250	250	A.C.	1	120	1,100	120	......	Small lighting plant; operates about 12 hours per day all year; head 41 ft.
Ladysmith: Municipal Steam Plant.	S	1	125	125	A.C.	1	115	2,200	115	......	Service 14 hours per day. Installed 1909.
Merritt City: Steam plant in city, 400 feet from Coldwater river	S	1	210	210	A.C.	1	125	2,300	125	2,200	Small lighting and water supply plant. Pumping is done by steam and electric pumps near river. Started Mar. 10, 1913.
Mirror Lake Electric Light Co.: Mirror lake Development on Bjerkness creek, 600 ft from mouth	W	1	50	50	D.C.	1	35	110	35	......	Small private lighting plant; 157 ft. head developed.
Mission Water, Light and Power Co. Ltd.: Mission. Development of Silverdale creek.	W	1	70	70	A.C.	1	55	250	55	......	Small lighting plant, 3 phase, 60 cycle. Distribution at 110 volts. 125 ft. head developed.
Montana Continental Development Co.: Skeena Crossing Development at Juniper creek, 4½m. from Skeena Crossing.	W	1	225	225	A.C.	1	187½	2,300	187½	......	Small mining plant, 180 ft head developed. Pelton-Doble wheel; belt drive.
Mount Olie Light and Power Plant: Nakalliston creek, 50m. north of Kamloops.	W	1	30	30	A.C.	1	......	2,200	......	......	Charles Barker and Sons turbine; belt drive to alternator and exciter. Supplies light and power to settlement at Mount Olie. 50 ft. head developed.
Mount Stephen Mining Syndicate: Field. Development on Cathedral creek.	W	1	100	......	......	......	......	......	......	......	Small mining plant. 300 ft. head. Pelton wheel belted to main shaft of mill. Steam auxiliary used during winter months.
Nanaimo Electric Light, Power and Heating Co.: Plant at Millstone river, 1m. from mouth.	W S	1 1	450 450	 900	A.C. A.C. A.C. E.	1 1 1 2	150 200 300 5½	2,300 2,300 2,300 110	650	......	177 ft. developed; 35 ft. earth dam. Auxiliary steam plant in adjoining building; compound engine direct connected to generator, 3 phase, 60 cycle.
Nelson City:* Development at Upper Bonnington falls.	W W	1 1	1,600 1,800	 3,400	A.C. A.C.	1 1	750 1,000	12,000 12,000	1,750	12,000	Head 54 to 62 ft. Wing dam intake. 2 circuit aluminium cedar pole transmission line, 10m. long, to Nelson.
Northern Telephone and Power Co.: Prince George.	S	2	......	650	A.C.	2	......	2,300	525	......	Small lighting plant; two units; Goldie and McCulloch Curtis turbines. Sub-station at South Fort George.
Okanagan Saw Mills Ltd.: Enderby.	S	1	100	100	A.C. E.	1 1	75 15	2,300 125	75	......	Small sawmill plant, runs every day, 18 hours in winter and 10 hours in summer.
Okanagan Securities Co. Ltd.: Naramata. Development on Mill creek.	W	1	60	60	A.C.	1	30	2,000	30	2,000	Pelton direct drive to alternator. 250 ft. head developed by 2,500 ft. pipe; 5-ft. dam, no storage. Pipe line also supplies water for irrigation for which purpose it is mostly used during season.

Pacific Mills Limited (successors to Ocean Falls Company) :*	W	3	900		A.C.	3	600	440	1,800		
Development at Link River, Cousins inlet.‡	W	6	1,400	11,100							Turbines direct connected to generators. Turbines driving grinders in groups of four. The h.p. given is for head of about 115 ft.
Peachland Municipality : Development on Trepannier creek 1m. above mouth.	W	1	150	150	A.C.	1	50	2,300	50	2,200	Ultimate capacity, 100 k.w. Plant operates 41 hours per day in winter and 17 hours in summer. Head 160 ft.
Pemberton Building : Victoria.	S			113	D.C.			110			
Penticton Municipality : Oil Engine Plant, Main st., Penticton.	O	1	200	200	A.C.	1	125	4,600	125	4,600	Dieselengine set; operates 16 to 18 hours per day in winter and 8 to 10 hours in summer, also one forenoon and one afternoon each week for flatirons.
					E.	1	5	125			
Powell River Company :* Development for Pulp and Paper plant at Powell River.	W	2	3,000		A.C.	2	2,200	550			Turbines direct connected to generators.
	W	1	3,600	9,600[1]	A.C.	1	2,500	550	6,900		Turbine direct connected to generator.
	W	4	1,800								Two pair turbines, each pair driving set of seven pulp grinders.
	W	2	3,600	24,000[2]							Two turbines, each driving set of six pulp grinders. Head developed 147 ft.
Prince George : Municipal Oil-Engine Plant.	O	2	150	300	A.C.	1	60	2,200			Two semi-Deisel engines belted to 3 phase, 60 cycle generators. Night service only. Installed 1917.
					A.C.	1	100	2,200	160		
Prince Rupert City :* Woodworth lake development, 7m. from city.	W	1	1,650	1,650	A.C.	1	1,125	4,400	1,125	4,400	Developed in connection with extension to water supply. Placed in operation Nov., 1914. 253 ft. head. 5½ m. transmission line.
Steam plant on First avenue in city.	S	1	145		E.	1	15				
Prince Rupert Dry Dock: Prince Rupert.	S	2	165	475	A.C.	3	100	4,400	300		Direct connected turbo-alternators, 60 cycle, 3,600 r.p.m.
	S	2	Turbines		A.C.	2	1,000	2,200	2,000		
Princeton Coal and Land Co. Ltd.: Steam plant at mine.	S	1	90	90	E.	3	35				Goldie and McCulloch engine, driving 3 phase, 60 cycle, Westinghouse alternator. Operates 17 hours per day in winter and 10 in summer.
					A.C.	1	50	2,200	50		
Princeton : See British Columbia Copper Corporation.											
Quatsino : Whalen Pulp and Paper Mills.	S	1	1,000		A.C.	1	750	2,200			Compound engines directly connected to 3 phase 60 cycle generators. Installed 1917. Used chiefly for Pulp and Paper Mills.
	S	1	1,400	2,400	A.C.	1	1,000	2,200	1,750		
Revelstoke City :* Development on Illecillewaet river.	W	1	900		A.C.	1	450	2,300			Head of 72 ft. developed. Supplies power to city and to shops of Canadian Pacific Railway. Producer gas standby, seldom needed.
	W	1	1,400[4]		A.C.	1	750	2,300			
	G	1	250		A.C.	1	150	2,300			
				2,550	E.	1	5½	125	1,350		
Salmon Arm : Small Private Lighting Plant	O	1	150	150	A.C.	1	110	2,200	110	2,200	Small lighting plant. Night service only.
Sandon Water-Works and Light Co.: Sandon. Development on Sandon and Tributary creeks.	W	1	175	175	D.C.	2	35	125	70		Pelton, belted to generators; 410 ft. head; 3 small dams; no storage. Night service only.
Sicamous : Canadian Pacific Railway Hotel plant.	S	1	35		D.C.	1	25	120			Small lighting plant chiefly for Hotel and Station. A few outside customers.
	S	1	45	80	D.C.	1	35	120	60		
Spences Bridge : Development on Murray creek, near mouth.	W	1	176	176	A.C.	1	75	2,300	75	2,300	255 ft. head developed; no storage; 12 ft. timber dam. By addition of extra pulley on Pelton shaft, duplicate generator may be driven.
					E.	1	3½	125			
Summerland : Development near lake front	W	1	75	75	A.C.	1	30	2,200	30	2,200	400 ft. developed; one Pelton; water derived from reservoir seepage collected by small wooden dam. Night service only.

[1] Horsepower varies with head, maximum capacity about 2,000 h.p. [2] Horsepower driving generators. [3] Total horsepower. [4] Replaces old 500 h.p. set.
* For fuller description, consult chapter dealing with Power Developments in British Columbia. † k.v.a.
‡ A new plant has recently been installed, comprising two units of 2,500 h.p. and one of 5,000 h.p. direct connected to two alternators of 1,850 k.w. and one of 3,750 k.w. respectively, 3 ph. 2,200 volts.

POWER PLANTS IN BRITISH COLUMBIA—*Continued*

Municipality or company and situation of plant	Prime Movers: Water,-W; steam,-S; gas,-G; oil,-O: Kind	No. of units	H.p. of each	Total horse-power installed	Generators: Alternating current,-A.C.; direct current,-D.C.; exciters,-E.: Kind	No. of units	K.w. of each	Voltage	Total kilowatt capacity of plant	High tension transmission voltage	Remarks
Surf Inlet Power Co. Ltd.: Development at head of Surf inlet, Princess Royal island	W	2	630	1,260	A.C. E.	2 2	375 12	440 125	750	13,200	Transmission line 6½m. long to mine. Pelton-Frances turbines, direct coupled to alternators, 73 ft. head developed.
Swanson Bay: See Whalen Pulp and Paper Mills.											
Trout Lake City: Development at Glacier creek near mouth.	W	1	50	50	A.C.	1	30	2,000	......	......	Small lighting plant, operates about 12 hours daily; 325 ft. head developed.
Vernon City: Steam Plant on North street, Vernon.	O O	1 1	200 525	... 725	A.C. E. A.C. E.	1 1 1 1	150 10 375 21	2,200 125 2,200 125	...... 525	.. 2,200	Diesel by Mirlees, Bickerton, Day, direct connected to Can. Westinghouse alternator and exciter. Diesel by Aktiebolaget Diesel Motorer (Sweden), direct connected to Canadian General Electric alternator and exciter.
Western Power Company of Canada:* Stave Falls. Development on Stave river, near Ruskin.	W W	3 2	13,000	39,000	A.C. E.	3 2	9,000 250	4,400 125	27,000	13,000 and 60,000	Power house is extended for additional unit which will complete development. Head 105 ft.
West Kootenay Power and Light Company:* Development at Lower Bonnington falls.—Plant No. 1.	W W	2 1	1,184 1,684	 4,052	A.C. A.C.	2 1	750 1,500	1,100 1,100	 3,000	 22,000	Normal working head, 34 ft., with variation up to 46 ft. Supplies power to Rossland, Trail, Nelson and Silver King Mine in conjunction with Plant No. 2.
Development at Upper Bonnington falls—Plant No. 2.	W W	2 2	8,000 9,000	 34,000	A.C. A.C.	2 2	5,625† 7,500†	2,300 2,200	about 25,000	60,000 and 22,000	Normal working head, 70 ft. Supplies power as above, also to Greenwood, Grand Forks, Phœnix and to Boundary Falls sub-station, which is 84 m. from plant.
Development at Cascade on Kettle river, 12m. below Grand Forks.	W	3	1,300	3,900	A.C. E.	3 2	750 45	2,200	2,250	22,000	Transmission lines to Grand Forks, Phœnix, Greenwood and Boundary Falls. Head 156 ft.
Whalen Pulp and Paper Mills, Ltd. (formerly British Columbia Sulphite Fibre Co.): Developments at Mill Creek and Cedar Creek, Howe sound.	W W W	1	300	...... 2,000 2,000	D.C.	1	200	125	....	....	Have 4,000 h.p. developed; 300 h.p. being electric balance Peltons direct connected to plant. Head 600 ft.
Whalen Pulp and Paper Mills, Ltd. (formerly Empire Pulp and Paper Mills Ltd.: successors to Swanson Bay Forests, Wood Pulp and Lumber Mills, Ltd.)	W W W W	1 1 1	350 200 75	 2,500	A.C. A.C. A.C.	1 1 1	250 150 50	500 500 500	.... 450	... ...	Turbines installed aggregating 2,500 h.p., 625 h.p. being hydro-electric. The ultimate development is stated to be 12,000 h.p. at present 132 ft. head is developed, possible total 342 ft.

* For fuller description, consult chapter dealing with Power Developments in British Columbia. † k.v.a.

CHAPTER VI

Electrical Inspection by Dominion of Canada and Exportation of Electricity

IN connection with the subject of the exportation of electrical energy, it is desirable to understand the circumstances which contributed to the passage of the legislation respecting this important matter.

By virtue of section 91 of the British North America Act, 1867, which empowers the Dominion to legislate respecting 'weights and measures,' the Parliament of Canada, May 23, 1873, passed the Gas Inspection Act,* appertaining to the standards for, and control of, the gas industry. The inspection was placed under the jurisdiction of the Department of Inland Revenue. Subsequent amendments to the Gas Inspection Act regulate more fully the producers and vendors of this commodity.†

Later, the supply of electrical energy for lighting and power began to assume commercial importance, and companies were formed for supplying electricity to municipalities and to other customers. The companies and individuals interested in the gas industry felt that the activities of their competitors from the electrical field should be under regulation corresponding to the restrictions in force with respect to gas. Hon. J. F. Wood, M.P., introduced the bills for the Electrical Units Act and the Electric Light Inspection Act. Respecting the former of these bills, he said: "Briefly, the intention of the Act is to establish the standards of measurements now in use by the electric companies. The bill itself in this respect is in line of the legislation that has already taken place in regard to weights and measures and the inspection of gas. It is claimed by the gas companies that there is no argument which makes for the inspection of gas that does not in like measure make for the inspection of their competitors, the electric light companies." ‡

Electrical Units Act

July 23, 1894, the Canadian Parliament passed two basic and important bills relating to the electrical industry. One, the Electrical Units Act,|| deals with the standardization of units governing the supply of electrical energy. With respect to certain units of electrical measure, it provides that "such standard apparatus as is necessary to produce them, shall be deposited in the Department of Inland Revenue and so form part of the system of standards in measure and weight established by the *Weights and Measures Act*." Pursuant to section 3 of this Act, Mr. Ormond Higman, in 1894, was called upon to procure the apparatus necessary

* *Statutes of Canada*, 36 Victoria, Chap. 48, 1873.

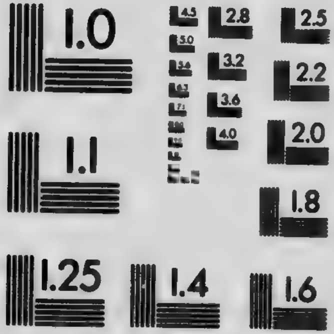
† *Re* Evolution of the Gas Inspection Act, consult *Statutes of Canada*, Chap. 48 of 1873; Chap. 37 of 1875; Chap. 35 of 1884; Chap. 69 of 1885; R.S. Chap. 101, 1886; Chap. 25 of 1890; Chap. 41 of 1900; Chap. 28 of 1901; R.S.C. Chap. 87 of 1906; Chap. 23 of 1910.

‡ See, *Debates of the House of Commons*, 18th May, 1894, p. 3003, relating to the first reading of Bill No. 117.

|| Re *Electrical Units Act*, see, 57-58 Victoria, Chap. 38 of 1894; R.S.C. 1906, Chap. 53; for modifications consult repealing act of 24th March, 1919.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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to produce and express the standard units therein legalized.* About 1912 a branch of the Ottawa Electrical Standards Laboratory was opened at Vancouver.

Electricity Inspection Acts

The other Act of 23rd July, 1894, known as *The Electric Light Inspection Act*,† was amended, and, in 1906, was repealed by the Electric Light Inspection Act, as given by chapter 88 of R.S.C., 1906. April 27, 1907, the Act of 1906 was superseded and repealed by the *Electricity Inspection Act, 1907*.‡ It deals with the electrical situation along lines corresponding in general to the Gas Inspection Act.

Under the Electric Light Inspection Act of 1894, electrical installations in British Columbia came under the jurisdiction of the Inspection Branch of the Dept. of Inland Revenue. By order-in-council of May 28, 1895, regulations giving effect to the provisions of this Act were made. These regulations stipulated that the inspection divisions under the Act shall be conterminous with the Inland Revenue divisions previously established. An order-in-council of October 14, 1912 established special electricity districts; British Columbia was subdivided into two districts.‖ The various operating companies are required to send in reports annually. The last annual report of the Department of Inland Revenue contains a list of electrical installations in British Columbia and cognate data respecting same.¶ (See table on page 144.)

Niagara Power Conditions and Exportation of Electricity

For the next important development relating to the subject under discussion, attention must be directed to the hydro-electric power situation on the Niagara river. For many years, the supply of Niagara's waters for power purposes was regarded by the general public as practically inexhaustible, notwithstanding the fact that various interests were already in possession of power concessions which, if put into operation, would have drained Niagara dry.

In both Canada and the United States, a number of public-spirited organizations had been watching this situation and, recognizing its menace, conducted a public propaganda which influenced the United States Federal Government to take action. Later, action was also taken by Canada.

In 1902, following a recommendation in the Rivers and Harbors Act of the United States, a tribunal was created, consisting of members appointed

* Standards first adopted followed recommendations made by the British Association Committee on Electrical Standards, published in the 'seventies,' also those of the Electrical Standards Committee of the Board of Trade. In this connection consult report by Mr. Higman, *Canada Sessional Paper* No. 13, 1902; reproduced from *Paper before Canadian Electrical Association*, read June 20, 1901.

† 57-58 Victoria, chap. 39, assented to July 23, 1894. Respecting amendments reference may be made to chap. 18 of 1897, chap. 29 of 1901 and chap. 20 of 1903.

‡ 6-7 Edward VII, chap. 14, assented to April 27, 1907.

‖ Consult order in council October 14, 1912 (in pursuance of R.S.C. 1906, chap. 24 sec. 23); also amending order in council October 27, 1915 (see *Statutes of Canada*, 1915, page clxiii, and *Canada Gazette*, vol. 49, page 1482).

¶ The first report published by the Department of Inland Revenue, giving data respecting the inspection of electrical apparatus in British Columbia, is for fiscal year ending 1897; fuller data is given in 1898; and in the report for 1899, data are separated, respectively, for the districts of Vancouver and Victoria.

by the United States and by Canada, known as the International Waterways Commission. In 1905, this Commission was requested to report upon the general conditions obtaining at Niagara Falls, looking to co-operation between both countries that proper and adequate steps be taken to prevent further or undue depletion of the Niagara waters.* The International Waterways Commission, in its early deliberations, adopted as one of the fundamental subjects for discussion "The transmission of electrical energy generated in Canada to the United States and *vice versa*."

The Commission conducted its investigations co-operatively with the U.S. War Department, and subsequently made its report. Certain recommendations, including the preservation of Niagara, the amount of water to be diverted on the United States side, and other features, were enacted into law by the Burton Act.

United States Legislation

The Burton Act of June 29, 1906, was "For the Control and Regulation of the Waters of the Niagara River for the Preservation of Niagara Falls and for Other Purposes." It was regarded chiefly as a temporary measure, and, in 1913, lapsed by limitation.†

In the United States, the War Department controls navigable streams. As the Niagara river is, from a legal standpoint, a navigable stream, the Secretary of War issues the *permits* (or licenses) to the companies utilizing the water, and the Corps of United States Engineers enforces the regulations essential to the carrying out of the provisions of the permits.

Canadian Legislation

Closely following the passage of the Burton Act, the Government of Canada, on April 27, 1907, passed an Act to Regulate the Exportation of Electric Power and Certain Liquids and Gases.‡ This Fluid Exportation Act, as it is shortly called, provides for the taking out afresh each year of *Licenses* permitting the *exportation* of electricity to the United States, and for a possible export tax not exceeding $10 per horse-power per year.

This Act prohibits the exportation of any electric power or fluid except under Government license, and subject to such regulations as, from time to

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* For more detailed history of events connected with the exportation of electrical energy arising out of power development on the Niagara river consult statement by Arthur V. White in *Water-Powers of Canada*, pages 56 *et seq.*, Commission of Conservation.

† For Burton Act see United States *Public Document* No. 307; also, United States *Statutes at Large*, 59th Congress, 1st Session, Vol. 34, Part 1, Chapter 3621, pp. 626-628.

‡ The *Electricity and Fluid Exportation Act*, 6-7, Edw. VII, Chapter 16 (Canada), assented to April 27, 1907, will be found as Appendix III, and the *Regulations of 4th November, 1907, under the Electricity and Fluid Exportation Act*, as Appendix IV, in *Water-Powers of Canada*, Commission of Conservation, Ottawa, 1911. The present *Form of License* to export power from Canada is given below.

Legislation in certain other countries has since been largely modelled upon the lines of the Canadian law, and Japan has followed the Canadian Act and Regulations almost in their entirety. See, *Electrical News*, Toronto, Feb., 1912, pp. 42-43.

LIST OF ELECTRIC LIGHT AND POWER INSTALLATIONS IN BRITISH COLUMBIA, REGISTERED UNDER THE PROVISIONS OF THE ELECTRICITY INSPECTION ACT.

Municipality or company	Address	Prime mover		Phase of system	Frequency of system	Generator voltage	Service voltages		No. of meters	
		Type	Horse power				Power	Lighting	Power	Lighting
District of Vancouver										
Adams River Lumber Co., Ltd.	Chase	Steam	75	1	125	1,100		110		46
Armstrong Electric Dept.	Armstrong	Water & Oil	110/200	3	60	2,200	110/2,200	110	5	210
Ashcroft Water, Elec. & Improvement Co.	Ashcroft	Oil	90	3	60	2,300	2,300	220	110	87
Britannia Mining & Smelting Co.	Britannia Beach	Water	11,250	3	60	6,600	220	110		179
B.C. Electric Railway Co.	Vancouver	Steam	18,000	3	60	2,200	220/2,200	110	1,844	40,322
Canadian Western Lumber Co., Ltd.	Fraser Mills	Steam	2,000/1,000	3	60	480	440	480	35	
Cascade Water Pr. & Lt. Co., Ltd.	Rossland	Water	1,000	3	60	2,000	2,000	110		4
Clayburn Company, Limited	Clayburn	Purchased						110		18
Cranbrook Electric Lt. Co., Ltd.	Cranbrook	Steam	500	2	60	2,200	220	110	12	610
Crow's Nest Pass Electric Lt. & Pr. Co., Ltd.	Coal Creek	Steam	275	DC.		220		220		
Crow's Nest Pass Electric Lt. & Pr. Co., Ltd.	Michel	Steam	400	DC.		220		220		
Daly Reduction Company, Ltd.	Hedley	Water	2,700	3	60	2,200/6,600	220/2,200	110		2
Denver Light & Power Co., Ltd.	New Denver	Water	55	3	60	2,300		110		5
Fernie, Corporation of City of	Fernie	Steam	250	2	66	2,300	230	115	14	600
Golden Lt., Pr. & Water Co., Ltd.	Golden	Steam	60 & 90	3	60	2,200	110	110		5
Granby Consolidated Mining, Smelting & Pr. Co., Ltd.	Anyox	Water & Steam	10,800	3	60	2,200	220/2,200	110	44	210
Grand Forks, Corporation of City of	Grand Forks	Purchased					2,200	110	11	390
Greenwood City Waterworks Co.	Greenwood	Water	125	3		4,400	4,400	110	1	5
Kamloops, Corporation of	Kamloops	Water & Steam	2,000	3	60	2,200	220/110	110	35	1,069
Kaslo, Corporation of	Kaslo	Water	200	2	60	1,200	1,200	108/110		2
Kelowna, Corporation of City of	Kelowna	Steam	620	3	60	2,300	220	110	38	499
Merritt, Corporation of	Merritt	Steam	200	3	60	2,300	220/2,300	110		295
Mission Water, Light & Power Co.	Mission	Water	75	3	60	250		110		25
Nelson, Corporation of City of	Nelson	Water	2,400	3	60	12,000	440/220	110		1,121
New Westminster, Corporation of City of	New Westminster	Purchased		3	60	2,300		110		3,330
Okanagan Saw Mills, Ltd.	Enderby	Steam	100	1	60	2,300	2,300	110		160
Okanagan Securities Co., Ltd.	Naramata	Steam	60	3		2,900		110		10
Penticton, Corporation of District of	Penticton	Oil	200	3	60	4,600		110		515

Akolkolex river, tributary to Columbia below Revelstoke. Over 300 feet fall in short distance.

Elk river, Cañon falls. From Dewdney trail bridge, Elko, B. C.

Cañon on Incomappleux river near Arrow lakes.

TYPICAL POWER STREAMS OF THE INTERIOR RANGES

Phoenix Electric Lighting Co., Ltd.	Phoenix	Purchased	....	....	....	....	250	110	1	19
Powell River Company, Ltd.	Powell River	Water	9,600	3	50	600	600	110/220	....	25
Prince George, Corporation of	Prince George	Oil	300	3	60	2,200	2,200	110	....	185
Prince Rupert, the City of	Prince Rupert	Water	1,650	3	60	2,200	....	110	44	803
Revelstoke, Corporation of City of	Revelstoke	Water	300	3	66	2,300	220	110	22	740
Rossland Water & Light Company	Rossland	Purchased	....	....	....	....	110	10	....	92
Salmon Arm, Corporation of	Salmon Arm	Oil	150	3	60	2,200	110	110	1	100
Sandon Water Works & Light Co.	Sandon	Water	175	DC.	....	125	....	110	....	....
South Kootenay Water Power Co.	Rossland	Purchased	....	....	....	....	....	....	....	....
Spences Bridge Lt. & Pr. Co.	Spences Bridge	Water	200	3	60	2,300	....	110	....	....
Sumas Electric Light Co.	Huntingdon	....	....	....	....	2,200	110	110	....	3
Summerland, Corporation of District of	Summerland	Water	....	....	60	2,200	....	110	....	158
Vancouver Power Co., Ltd.	Vancouver	Water	64,200	3	60	2,200	....	....	....	....
Vernon, Corporation of	Vernon	Oil	725	3	60	2,300	220	110	23	700
West Kootenay Pr. & Lt. Co., Ltd.	Rossland	Water	28,000	3	60	2,500	220/550	110	42	....
Western Power Co. of Canada, Ltd.	Vancouver	Water	40,000	3	60	4,400	220/550	115	553	1,100

District of Victoria

Alberni, Corporation of	Alberni	Purchased	....	....	....	....		....	....	61
B.C. Electric Railway Co., Ltd.	Victoria	Water	2,300	3	60	700	2,200/500	110	385	13,176
Canadian Collieries (Dunsmuir), Ltd.	Cumberland	Water	10,000	3	25	13,200	2,200/440	110	2	146
Courtenay, Corporation of	Courtenay	Purchased	....	....	....	....	110	110	15	115
Cumberland Elec. Lighting Co., Ltd.	Cumberland	....	....	....	....	....	110/220	110	7	513
Duncan, Corporation of	Duncan	Oil Engine	2/100	3	60	2,200	220/110	110	3	161
Ladysmith, Corporation of	Ladysmith	Steam	160	3	60	2,200	....	110	....	433
Nanaimo [illegible], Pr. & Heating Co., Ltd.	Nanaimo	Water & Steam	900	3	60	2,300	110/220	110	14	1,787
Pemberton Building, The	Victoria	Steam	113	DC.	....	110	110	110	1	13
Port Alberni, Corporation of	Port Alberni	Oil	150	3	60	2,300	....	110	....	145
Sayward, J. A.	Victoria	Purchased	....	....	....	....	500/220	110	6	14
Uplands Limited, The	Victoria	Purchased	....	....	....	....	220	110	4	17
Vancouver Portland Cement Co., Ltd.	Tod Inlet	....	....	....	....	....	....	110	....	15
Vancouver Island Power Co., Ltd.	Victoria	Steam	6,000	3	60	2,300	....	....	....	....
Vancouver Island Power Co., Ltd.	Victoria	Water	25,500	3	60	2,300	....	....	....	....
Victoria Electric Company	Victoria	Purchased	....	....	....	....	....	110	....	19

time, may be imposed by the Governor in Council. Clause 10 of the Act states that:

1. The Governor in Council may, by proclamation published in *The Canada Gazette*, impose export duties, not exceeding ten dollars per annum per horse-power, upon power exported from Canada, or not exceeding ten cents per thousand cubic feet on fluid exported from Canada, and such duties shall be chargeable accordingly after the publication of such proclamation.

2. The Governor in Council may, by proclamation published in like manner, from time to time remove or re-impose such duties or vary the amount thereof.

3. The Governor in Council may, by proclamation published in like manner, exempt from the payment of such duties such persons as comply with the direction of the Governor in Council with regard to the quantity of power or fluid to be supplied by such persons for distribution to customers for use in Canada.

The Regulations under the Act were established by an order in council passed on November 4, 1907. The licenses are for the term of one year. Clause 3 of the Regulations stipulates that :

The contractor shall, on or before the 1st day of April of each year, make application for the license referred to in the previous paragraph and shall pay therefor the following fee, namely :

(*a*) In the case of an electrical plant generating not more than 10,000 horse-power, twenty-five dollars ;

(*b*) In the case of an electrical plant generating over 10,000 horse-power, fifty dollars ;

(*c*) In the case of a natural gas plant, fifty dollars.

The 'License' at present in use in accordance with the Fluid Exportation Act and the Regulations made thereunder, contains special provisions respecting contracts for sale of exported electrical energy. The object of these provisions is to ensure the purchaser of such exported electrical energy being seized of the fact that the exporter's license is only a *yearly* privilege. The Form of License at present in use is as follows :

LICENSE NUMBER............is hereby granted to the.......... . doing business at........................in the County of.............. ....and Province of..................................

to export or to sell for export from Canada during the fiscal year ending 31st March, 191.., electrical energy at a rate not to exceed at any time during the continuance of the license,.............................. kilowatts, provided :

(a) *That momentary indications in excess of the authorized quantity, due to short circuits, grounds, etc., will not be considered as violations of this license, and*

(b) *That the maximum demand or peak of load curves will not be considered as a violation of the license when such peak does not exceed twenty-five percentum of the quantity herein stated, and does not continue for a longer period than one hour at any time, and for not more than two hours altogether in any twenty-four hours.*

This license being only for one year, licensees must not enter into any contract which they will not be able to carry out if this license is not

renewed, or if the Electricity and Fluid Exportation Act or the Regulations made thereunder are changed.

This license is subject to the Statutes of Canada, now in force, or hereafter to be enacted and also to the provisions of the Regulations regarding electrical power, etc., approved by the Governor General in Council on the 4th day of November, 1907, and to any Regulations which may hereafter be made, which Statutes and Regulations are made conditions hereof.

Every contract made under this license shall contain a clause or clauses expressly setting forth that it is made by virtue of this license, which is subject to the Electricity and Fluid Exportation Act and any amendments that may be made to it, and also is subject to the Regulations made or which may be made by the Governor General in Council regarding the same ; and every contract made under this license shall have attached thereto a copy of this license and of the Electricity and Fluid Exportation Act, and of the Regulations approved by the Governor General in Council on the 4th day of November, 1907.

This license, if renewed, shall be subject to the terms and conditions of such Regulations as may be made from time to time, either by Statute or the Governor General in Council.

Except in Manitoba, Saskatchewan, Alberta, the North-West Territories, certain railway lands in British Columbia and certain other relatively minor exceptions, the control of waters for power purposes is vested in the various provinces of the Dominion. The exportation of electrical energy from any province, however, is under the control of the Federal Government.

The Electricity and Gas Inspection Acts are administered by the Dept. of Inland Revenue* Ottawa, the department charged with the imposition and direct on of revenue taxes on commodities of home production or consumption. Consequently, taxes imposed upon the exportation of gas or electricity fall under the jurisdiction of this department, which issues the yearly licenses and, through the agency of its Gas and Electricity Inspection Branch, provides certain supervision of the operations of the power companies.

[illegible]ay be commented that the amount of revenue derived from the [illegible] industries is relatively insignificant compared to the capital [illegible]

[illegible]om the foregoing it is clear that the *Burton Act*—a United States measure—regulated the *importation* of electrical energy into the United States, while the Canadian measure, the *Fluid Exportation Act*, regulates the *exportation* from Canada.

Electricity Exportation from British Columbia The amounts of electrical energy for which licenses have been granted to power companies operating in British Columbia, also the quantities of electrical energy generated by these companies, since 1911, for export and for consumption in Canada are as follows :

* *Author's Note :* While this Report was in press, it was learned that, upon the recommendation of the *Committee on Rearrangements and Transfers of Duties of the Public Service*, the administration of various Acts, including the "Electricity Inspection Act," the "Electrical Units Act," and the "Electricity and Fluid Exportation Act," was transferred, by order-in-council, from the Department of Inland Revenue to the Department of Trade and Commerce, Ottawa. The transfer includes the officials charged with the administration of the Acts, and is effective on 1st September, 1918.

ELECTRICAL ENERGY GENERATED FOR EXPORT TO THE UNITED STATES AND FOR CONSUMPTION IN CANADA, BY HYDRO-ELECTRIC COMPANIES IN BRITISH COLUMBIA

Fiscal year ending March 31	Units generated for export		Units generated for consumption in Canada		Total output of generating station or other source	
	Kilowatt hours	H.P. years	Kilowatt hours	H.P. years	Kilowatt hours	H.P. years
British Columbia Electric Railway Company—Vancouver						
1912	64,820*	10*	80,152,596	12,265	80,217,416	12,275
1913	282,383	43	120,789,188	18,476	121,071,571	18,519
1914	395,831	61	114,697,400	17,551	115,093,231	17,612
1915	397,709	61	81,629,981	12,488	82,027,690	12,549
1916	330,626	51	68,470,689	10,477	68,801,315	10,528
1917	296,190	45	60,874,625	9,315	61,170,815	9,360
1918	327,832	50	76,419,718	11,694	76,747,550	11,744
Western Canada Power Company—Vancouver						
1912†	30,960	5	1,154,547	176	1,185,507	181
1913	3,259,69[illegible]	499	18,191,562	2,785	21,451,255	3,284
1914	23,213,891	3,552	39,339,239	6,020	62,553,130	9,572
1915	18,219,238	2,788	52,334,262	8,009	70,553,500	10,797
1916	11,937,700	1,827	60,468,020	9,253	72,405,720	11,080
1917	13,692,820	2,095	78,796,210	12,057	92,489,030	14,152
1918	14,242,756	2,179	72,014,814	11,020	86,257,570	13,199

Boundary Waters Treaty

The Burton Act recommended the opening of negotiations between the United States and Great Britain with the object of regulating and controlling the waters of the Niagara river and its tributaries. Negotiations were opened in 1905, but were interrupted. Later, they were resumed. The *Boundary Waters Treaty* was signed at Washington January 11, 1909, and ratified May 5, 1910.‡ It relates to all boundary waters between Canada and the United States, Article V relating specifically to the Niagara river.

The Burton Act and the Treaty were, for a time, co-existent, the Act remaining effective until its expiration in 1913.

The carrying out of the terms of the Boundary Waters Treaty, as well as adjudication upon certain differences between the two countries arising out of the use of boundary waters, is now vested in the International Joint Commission, which tribunal, in many respects, corresponds to the former International Waterways Commission. Its functions and powers, however, as defined by the Treaty and in the Rules of Procedure, are broader, and means of adjusting differences between the two countries are available through the

* For last four months only of fiscal year, as export did not commence till December, 1911.

† For last three months only of fiscal year, as export did not commence till January, 1912.

‡ The Boundary Waters Treaty is reproduced as *Appendix* I in *Water-Powers of Canada*, Commission of Conservation, Ottawa, 1911. Regarding items recommended by the Canadian Section of the International Waterways Commission for embodiment in the proposed Treaty, see *Sessional Papers*, Canada, 19a, 1907, pp. 101-102.

instrumentality of this Joint Commission. The Boundary Waters Treaty is based upon the *Doctrine of Equal Benefits.* Expressed in general terms, each country is entitled to receive its full share of the benefits derivable from the use of one-half of the waters which would naturally flow in such boundary waters as the Niagara river. If each country receives the share to which it is entitled there can be no just ground for contention or dissatisfaction.

Critical study of the various factors discussed, including the International Waterways Commission, Burton Act, Fluid Exportation Act, Boundary Waters Treaty, International Joint Commission and of the functions exercised by the Secretary of War, Washington, D.C., by the Department of Inland Revenue, Ottawa, by the Department of Trade and Commerce, Ottawa, by the Province of British Columbia and by other organizations, permits intelligent understanding of events as they arise in connection with this very important subject—the exportation of electricity.

NOTE—For discussion of various aspects of problems respecting the exportation and use of electrical energy, consult the following articles by Arthur V. White : "Exportation of Electricity," which appeared in the *University Magazine*, October, 1910, pages 460 *et seq.* Consult, also, *Toronto World*, March 18th, 1912 ; also "Exportation of Electricity—An International Problem ; Relation of a Possible Coal Embargo by United States to a Curtailment or Stoppage of Canada's Electric Power," in *The Monetary Times Annual* of January 5th, 1917, pages 21 *et seq* ; also, "Coal Problem of Canada Demands National Action—A Solution of a Vital National and International Question," in *The Monetary Times Annual*, January 4th, 1918, pages 25 *et seq* ; also consult "Barter Power for U.S. Coal," in *The Globe*, Toronto, 27th Nov., 1917 ; and *Monetary Times*, Toronto, 18th Jan., p. 9, and 22nd Feb., p. 26, 1918.

For several years past attention has been drawn by Mr. White to the relatively limited use that can efficiently be made of electrical energy as a heating agent. On Feb. 11, 1918, when addressing the important Fuel Conference held by municipalities in Galt (see, *Galt Reporter*, 12th Feb., 1918), Mr. White again emphasized his contention that, as a general proposition, electrical energy is more serviceably employed for strictly power purposes, while fuel, such as coal, oil, etc., is more profitably employed for heating. At this meeting he set forth the underlying principles governing in this matter. See, *Monetary Times*, 1st March, 1918, p. 18 Consult, also, *Annual Reports of Commission of Conservation*, Ottawa ; and article by Mr. White, "Electricity will not Replace Coal," in *Industrial Canada*, Toronto, April, 1918. The official minutes of the meeting held by Ontario municipalities at Galt on "fuelless-Monday" are published in *The Monetary Times* for 25th October, 1918, pp. 5 to 8, and concluded in the issue of 1st November, 1918, pp. 18 to 22.

CHAPTER VII

Power Developments in British Columbia

IN British Columbia there has been considerable development of water-powers, both for municipal and industrial purposes. In fact, development of this resource has contributed much to the general advancement of the Province.

Below, the more important of the existing installations are described briefly. Such descriptions not only show what course has been pursued upon various types of streams, but also set forth the general design and character of such equipments as have been employed in the respective developments.

British Columbia Electric Railway Co., Ltd.

The history of hydro-electric development in British Columbia is intimately associated with the early activities of what is now the British Columbia Electric Railway Co., Limited.

In 1887, the Vancouver Electric Illuminating Co., Ltd., installed an electrical plant. In 1889, a second company, known as the Vancouver Electric Railway Co., Ltd., was formed. The following year, the two companies were merged and their railway lines electrically operated. In 1890, a New Westminster interurban system and a Victoria (Vancouver island) system were commenced. These were merged into one company, known as the Consolidated Railway Co., Ltd., and their lines were operated under this control until 1897, when the British Columbia Electric Railway Co., Ltd., was formed, and, subsequently, acquired the assets of all the companies above referred to.

Confident in the development of the territory to be served, the directors of the company, at the outset, formulated their plans with respect to future development. There is no doubt that the remarkable development which has taken place in the districts around Vancouver, New Westminster and Victoria has been largely assisted by the liberal expenditures of the British Columbia Electric Railway Co. at a time when settlement in the province was being stimulated. The company's operations now extend over a field which contains over half the population of British Columbia.

The supply of power for the company's various undertakings is obtained from five power stations. On the mainland, the Vancouver Power Co., a subsidiary, operates a large and up-to-date hydro-electric plant on the North arm of Burrard inlet. It also operates a steam plant in the city. For Victoria and vicinity, the company owns and operates a hydro-electric plant at Goldstream, and an auxiliary steam plant at Brentwood Bay. The Vancouver Island Power Co., a subsidiary, operates a hydro-electric plant at Jordan River.

Coquitlam-Buntzen

The plant on Burrard inlet, known as the Coquitlam-Buntzen development, is the largest in the province. It consists of two power-houses at sea-level, utilizing water diverted from Coquitlam lake, through a tunnel 2¼ miles long, to lake Buntzen, a small lake 400 feet above sea-level, and but a short distance from Burrard inlet.

The utilization of lakes Coquitlam and Buntzen for power purposes was decided upon sometime prior to 1898, and power was first supplied from power-house No. 1 to Vancouver in December, 1903. The original scheme comprised raising Coquitlam lake, by means of a small rock-filled crib dam, about 11 feet above its average summer level. Water so stored was delivered through a tunnel 2¼ miles long—then stated to be the longest purely hydro-electric tunnel in the world—to Buntzen lake, at the outlet of which a concrete intake dam, 54 feet high, was built across the cañon.

The rapid development and growth of the district around Vancouver demonstrated that the demand for power would, in a short time, exceed the maximum capacity of the plant. After careful investigation, it was decided to enlarge the tunnel connecting lakes Coquitlam and Buntzen, and build a new dam to increase the storage capacity of Coquitlam lake. Extensive additions were also provided at the power-house.

By the time the enlargement of the tunnel was completed, in June, 1911, the demand on the company's system necessitated the construction of a second power-house. Work on the extension was commenced in 1911, and the first unit placed in operation in October, 1913. The construction of the new dam and of No. 2 power-house completes the hydro-electric development of the Coquitlam-Buntzen scheme.

Coquitlam lake is about 7 miles in length, with an average width of about one-third of a mile. Its original area was about 2,190 acres. The area of the watershed is approximately 105 sq. miles. The surrounding mountains rise precipitously to a height of 3,000 to 6,000 feet and the greater portion of the watershed is well timbered. The annual precipitation during the last eleven years has averaged over 150 inches. The snowfall is very heavy and remains on the higher peaks until late in the summer. To provide storage to enable the entire runoff from the watershed to be utilized, it was necessary to raise the level of the lake; the spillway of the new dam is at elevation 503 feet, 60 feet above the old dam.

The new dam (see Plate 4) is of the hydraulic-fill type, with heavy rock toes. It is built at the outlet of the lake, upon a natural barrier. Its crest elevation is 518 feet, and the maximum height of the dam, above the lowest point of the foundation on the centre line, is 100 feet. The length along the crest, including the spillway, is 1,200 feet. The slope of the upstream face is 1 in 5, and of the downstream face 1 in 2 to 1 in 4. The spillway is cut through a solid rock spur at the east end of the dam. The concrete sill at the entrance to the spillway is at elevation 503, being 15 feet below the crest of the dam. During the construction of the dam, the outflow from the lake was carried around the dam site in a tunnel driven under the spillway, and designed to

carry 12,000 c.f.s. For controlling the flow through this tunnel, permanent gates are placed in a concrete tower at its upper end.

As the city of New Westminster had drawn its water supply from Coquitlam lake since 1892, and as the raising of the lake level rendered the original municipal intake works useless, an entirely new intake had to be provided. For the protection of the New Westminster water supply, extensive clearing operations along the shores of the lake were carried out by the company.

The total length of the tunnel which conveys water from Coquitlam lake to lake Buntzen is 12,650 feet. It originally had a square section about 9 by 9 feet, with rounded corners, and was designed to carry 500 c.f.s. The area of the section was subsequently enlarged to 192 sq. feet, which is sufficient for the ultimate carrying capacity required by the scheme. The intake to the tunnel was rebuilt when the new dam was constructed. It consists of a heavy masonry retaining wall, founded on bedrock and built against the steep hill above the tunnel entrance. This entrance is protected by a rack, and two independent sets of head-gates are provided for controlling the flow of water through the tunnel. One of these gates is of the Coffin type, 9 feet in diameter; the second set consists of two Stoney sluice gates placed side by side.

A range of mountains, which reaches an elevation of 4,000 ft., separates Coquitlam and Buntzen lakes. The watershed of lake Buntzen is 7 sq. miles and the average annual precipitation during the last 12 years has been over 110 inches. The area of the lake is about 500 acres, and, by the construction of a concrete dam, 54 feet high and 361 feet long on the crest, in a cañon below the outlet, the lake has been made into an excellent forebay. The crest of the dam is 400 feet above sea-level. Ten outlets 54 inches in diameter and two outlets 24 inches in diameter were provided. To these are connected the pipe-lines which convey water to power-house No. 1.

The water for power-house No. 2 is obtained from lake Buntzen, through a concrete-lined pressure tunnel, 14 feet 8 inches in diameter and about 1,800 feet long, driven through solid rock, and controlled by three Doble needle intake valves, placed with their seats on a concrete foundation on the bottom of the lake. These needle valves are operated by oil pressure, and an outer cylinder is provided which may be lowered down to a horizontal seat, enabling them to be inspected without the use of a diver. Near the lower end of the pressure tunnel, and close to the top of the hill, a steel surge tank, 30 feet in diameter, is provided, and from this point three steel pipe-lines conduct the water to power-house No. 2. These pipe-lines are each 8 feet 6 inches in diameter at the surge tank, and taper to a diameter of 7 feet at the power-house. About 200 feet from the power-house the pipe-lines pass through tunnels driven in the solid rock. A Pelton-Doble-Venturi butterfly valve is installed in each pipe-line.

No. 1 power-house is situated on the east shore of the North arm, about 16 miles from Vancouver. The buildings were erected from the granite blasted out to form the site for the generating station. The main floor is about 5 feet above high-water. The original installation has been added to from time

LOWER BONNINGTON FALLS, KOOTENAY RIVER
West Kootenay Light & Power Co's Plant No. 1 in foreground. Upper Bonnington Falls in back ground; here Plant No. 2 is located, also the City of Nelson plant.

KOOTENAY RIVER. TYPICAL VIEW OF RAPIDS IN LOWER PORTION OF RIVER

to time. Steel penstocks convey water from the intake dam at the outlet of lake Buntzen. Units Nos. 1 to 4 are each supplied by means of a pipe-line 48 inches in diameter and 2,000 feet in length. Two pipe lines, 60 inches in diameter, are provided for the fifth unit. One pipe-line, 84 inches in diameter at the upper end and tapering to 72 inches at the power-house, is provided for the sixth unit, and a similar pipe-line conveys water to unit No. 7. The present equipment consists of four 3,000-h.p. Pelton water-wheels, driving four 1,500-k.w., 3-phase, 60-cycle Westinghouse generators; one 10,500-h.p. Pelton water-wheel, driving one 5,000-k.w., 3-phase, 60-cycle Canadian General Electric generator; one 10,500-h.p. Doble water-wheel, driving one 5,000-k.w., 3-phase, 60-cycle Dick-Kerr generator; and one 10,500-h.p. Doble water-wheel, driving one 5,000-k.w., 3-phase, 60-cycle Canadian General Electric generator. All of the above units have a speed of 200 r.p.m. and are of the horizontal type, the water-wheel and generator being, in each case, mounted on the same shaft. In addition to the above equipment, there are four exciter units, each a direct-current generator with an induction motor at one end of the shaft and the water-wheel on the other. The transformers and high tension switching equipment are housed in a separate building, erected on the hillside behind the power-house.

In 1911, as it was impracticable to build further extensions to power-house No. 1, a new site was selected, about one-third of a mile south. Power-house No. 2, of reinforced concrete, erected on solid rock, is a fine building of massive proportions and careful design. It contains three horizontal units, each consisting of 4 Pelton-Doble water-wheels, the combined capacity of which is 13,500 h.p. They are mounted on one shaft, together with the revolving field of a Dick-Kerr 8,900-k.v.a., 3-phase, 60-cycle alternator. Close to the back wall of the power-house the main pipe-line divides into four branches, each branch supplying water to one wheel of the unit. The speed of each unit is 200 r.p.m., and regulation is secured by a Lombard governor, auxiliary relief nozzles being provided. There are three 300-k.w. exciter units, consisting of a Dick-Kerr induction motor-generator set, direct driven by one Pelton-Doble water-wheel mounted on one end of the shaft. The transformer room and switching equipment are located in the same building.

Current is generated at 2,200 volts and stepped up to 34,600 volts, for transmission to sub-stations in Vancouver, and adjacent territory. It is understood that the transmission voltage will soon be increased to 60,000 volts. The two outgoing circuits from plant No. 1 are carried on wood poles; the other two circuits—the outgoing lines from plant No. 2—are carried on steel towers. A tie-line connects power-houses Nos. 1 and 2.

The plants and equipment above described reflect great credit upon the company and its engineers.

Victoria Power Supply

Power and light are supplied to the city of Victoria by the British Columbia Electric Railway Co. and its subsidiary, the Vancouver Island Power Co.

There are two hydro-electric plants : one at Goldstream, 12 miles from Victoria, and the other at Jordan River, 40 miles distant. There is also a steam electric plant at Brentwood Bay, 12 miles distant.

Prior to 1898, the city was supplied with light and power from steam plants situated within the city limits, and also owned by the British Columbia Electric Railway Co.

Goldstream

In September, 1897, an agreement was made with the Esquimalt Water-works Co., for the supply of a maximum and minimum daily amount of water to the British Columbia Electric railway, for a hydro-electric plant to be built at Goldstream. This agreement stipulated that all water supplied for power purposes would be returned to the Water-works Company's reservoir below the power-house site, and in condition suitable for domestic use. In 1898, the British Columbia Electric Ry. Co. constructed its Goldstream power-house.

The Esquimalt Water-works Co. has five storage reservoirs at Goldstream, situated at elevations of from 1,200 to 1,500 feet above sea-level. From them the water flows first to a balancing reservoir of 3,500,000 cu. ft. storage capacity, and at elevation 1,100, then through the Goldstream plant and, thence, to a lower reservoir at elevation 450, affording a head of 650 feet. The capacity of these reservoirs is sufficient to take care of considerable daily fluctuations. The penstock bringing water from the balancing reservoir to the power-house consists of 4,000 feet of 33-inch, and 4,000 feet of 30-inch steel pipe.

The initial equipment, which went into operation in September, 1898, consisted of two Pelton water-wheels of 600 h.p. each, direct connected to two 350-k.w., 3-phase, 60-cycle, 700-volt generators. In 1903, a third unit of 500-k.w. was installed. In 1905, a fourth direct-connected unit, of 1,000-k.w. capacity, was added, and is driven by two water-wheels, each of 1,000 h.p. The energy is stepped up from 700 to 17,500 volts and transmitted over a two-circuit, single-pole transmission line 12 miles long, to Rock Bay sub-station at Victoria.

Jordan River

The second hydro-electric plant, supplying power to Victoria, is situated at the mouth of Jordan river, which flows into the strait of Juan de Fuca, about 40 miles west of the city. The Jordan is a mountain stream, flowing in a south-westerly direction through a deep and precipitous valley. It drains about 61 square miles—the greater portion lying at an elevation of over 1,200 feet. The entire watershed is heavily forested. The drainage area above the intake, including the area above Alligator Creek diversion, is 50 square miles.

The precipitation on the western slope of Vancouver island is heavy. At the mouth of the Jordan river it averaged, during the period 1908 to 1915, about 70 inches annually, and, in the vicinity of Bear creek, at an elevation of 3,600 feet, an average of about 95 inches has been recorded during the last five years. Probably the average over the whole watershed exceeds 90 inches per year. At the higher altitudes, there is a heavy fall of snow during the winter months, which often remains on the ground until June or July. When this snow disappears, the flow of the Jordan falls off very rapidly. To compensate for low-water flow, storage reservoirs have been provided. Although there are

no large lakes in the watershed, five sites, suitable for storage dams, have been located. Two of these dams, known as the Bear Creek dam and the Jordan dam, are now completed.

Bear creek flows into the Jordan 3½ miles above the main diversion dam. The storage dam on this creek lies about a mile above its junction with Jordan river. It is an earth hydraulic-fill embankment. Its greatest height is 57 feet, and the length, on the crest, is 1,020 feet. Impermeability is secured by a sheet-steel-piling curtain-wall driven to bedrock across the valley. It is proposed, ultimately, to raise this embankment to 75 feet. A spillway is excavated out of solid rock at the north end of the dam. This dam forms a lake of 285 acres, and provides storage of 328,000,000 cubic feet. The area of Bear Creek watershed above the dam is about 8 square miles. The dam was commenced in November, 1910, and completed in April, 1912.

The Jordan dam (see Plate 4) is on the Jordan river, immediately below the junction of Wye creek. Here, the cañon narrows and is crossed by a ridge of rock which extends well up both sides of the cañon. This site was early recognized as the best for a permanent dam.

The Jordan dam is a hollow, reinforced-concrete structure of the Ambursen type. Its extreme height is 126 feet, and the length along the crest 891 feet. The crest elevation is 1,268 feet above sea-level. The upstream face of the dam consists of a reinforced-concrete face, or deck, inclined at an angle of 45°. This is supported on concrete buttresses, spaced 18 feet centre to centre. These buttresses are 12 inches thick at the top, and increase, by steps of 12 feet in height, to a thickness of 42 inches at the bottom of the highest buttress. The down-stream edge has a batter of 1 to 4 from the base to a point 18 feet below the crest, above which point it is vertical. A spillway, 305 feet long, with a crest 8 feet below the top of the dam, is provided near the east end. The spillway has a curved crest and rollway apron, and provides for a discharge of 23,000 cubic feet per second.

The main flume, for about 5½ miles, follows the eastern side of the Jordan valley from the dam to the forebay reservoir. The side of the valley is steep for the entire distance and precipitous in places. The flume is 6 by 6 feet, with a grade of 1 foot in 1,000, and designed to carry 175 c.f.s. Five sandboxes, with gates in the side of the flume, are provided.

The forebay consists of a small artificial lake of 4,350,000 cu. ft. storage capacity, formed in the flat between two hills, by two earth-filled embankments. These were built of the material excavated from the higher ground lying between them, thus adding to the capacity of the reservoir. The maximum height of each dam is 35 feet. Suitable spillway is provided. Two steel pipes, with 54-inch diameter sluice-gates, connect at the dam to the pipe-lines which convey water to the power-house. One provides water for units Nos. 1 and 2, the second serves unit No. 3. The pipe-line serving units Nos. 1 and 2 is 44 inches in diameter and 3,010 feet long. At its lower end a Y is provided for two pipes, each 6,280 feet long and 36 inches in diameter at the upper end, tapering to 30 inches diameter at the power-house. Both pipe-lines are controlled by

gate valves placed just below the Y pipes. The pipe-line for No. 3 unit has a total length of 9,290 feet, and tapers from 54 inches in diameter to 48 inches at the power-house. The head at the power-house is 1,145 feet.

The original power-house, as completed in 1911, was a concrete structure with two units, each of 4,000-k.w. capacity. Recently, it has been enlarged; a new 8,000-k.w. unit has been added, space has been provided for a fourth unit and a new high tension switch-room has been built. The power-house is of reinforced concrete, resting on concrete piles, 12 inches in diameter, penetrating to bedrock at a depth of 45 to 75 feet. It contains three units. Units Nos. 1 and 2 each consist of a single Doble water-wheel of 6,000 h.p., coupled direct to a 4,000-k.v.a., Allis-Chalmers-Bullock, 3-phase, 60-cycle generator at a speed of 400 r.p.m. Speed regulation is obtained by a Lombard oil-pressure governor. No. 3 unit consists of one 8,000-k.v.a., 3-phase, 60-cycle, Canadian General Electric generator, driven by two Pelton-Doble water-wheels, one mounted on each end of the shaft. The water-wheels are together rated at 13,000 h.p. Each wheel of No. 3 unit is provided with a separate oil-pressure, relay-type Pelton-Doble governor. There are three exciter units, two of which consist each of a 100-k.w., 125-volt, d.c. generator, direct driven by a 150-h.p. water-wheel and also by a 150-h.p. induction motor ; the third is a 200-k.w., 125-volt, d.c. generator, on the shaft of which are mounted a 300-h.p. induction motor and a 200-h.p. water-wheel. Water is supplied to the exciter units from a header connected to all three pipe-lines. Valves are arranged so as to permit any exciter unit to be driven by water from any pipe-line.

Current is generated at 2,200 volts and stepped up to 60,000 volts for transmission to Victoria. The transmission line is about 37 miles long. For about 15 miles the line, which is of aluminium cable, follows the shore, and then strikes inland to Victoria, terminating in the Rock Bay sub-station. The poles are of cedar, cut along the line. Cross-arms for two circuits are provided, but only one has been installed.

Britannia Mining and Smelting Co., Ltd.

Developments at Britannia Beach, Howe Sound

One of the most interesting water-power developments on the Pacific coast is that of the Britannia Mining and Smelting Co., on Britannia creek, which flows into Howe sound, about 28 miles from Vancouver. Its chief interest lies in the utilization of a succession of high heads and in the large amount of power developed from what, relatively speaking, is quite a small stream.

In 1905, development work on this property for the mining of copper was commenced. Since then the plant has been steadily enlarged and the output increased. Mining operations are carried on about four miles from the beach, at an elevation of 3,500 feet above sea-level. Preliminary crushing of the ore is accomplished inside the mine ; it is then transported by gravity aerial tramways to bunkers above the concentrating mill, situated about 500 feet from the foreshore and 160 feet above sea-level. From these bunkers the ore is drawn into the concentrating mill. After passing through crushing, washing

and oil flotation processes, the concentrated product is shipped to the smelter at Tacoma, Wash.*

Britannia creek is a small mountain stream about 7 miles in length, falling in this distance about 5,000 feet. It has three small tributaries : Marmot, Jane and Mineral creeks. No important lakes were found on this watershed, but some storage has been created near the headwaters, at an elevation of 4,130 ft., by the construction of a reinforced-concrete main dam, 50 ft. high and 225 ft. long, and a wing dam 340 ft. long, with an average height of 18 ft. The stored water is discharged into the natural bed of the river to augment the low-water flow as required. Further storage dams are under construction.† The annual snowfall amounts to from 15 to 20 feet at the higher elevations.

Power is developed at five points, Tunnel power-house, Beach power-house, Beach compressor-house, old Concentrating mill, and the new Concentrating mill. ‡

Tunnel Power-house

The Tunnel power-house is situated about three miles from the beach, at elevation of 2,084 feet. The principal head developed at this point is 1,464 feet. At an elevation of 3,547 feet, a reinforced-concrete dam, 485 feet long by 40 feet high, is constructed on Britannia creek. From this dam, a pipe-line was constructed, 11,125 feet long. This consists of 3,225 feet of wood-stave pipe, 24, 22 and 20 inches in diameter, and 7,900 feet of steel pipe, 20, 18 and 16 inches in diameter, and delivers water to the Tunnel power-house under a pressure of 635 lbs. per square inch, corresponding to the head above mentioned. In addition to this pipe-line, another system of pipes brings water to the power-house under a head of 838 feet. A small intake dam has been built, about 1 1-3 miles distant, up Britannia creek from the power-house ; water is conveyed through 3,600 feet of 18-inch wood-stave and 4,500 feet of 15-inch steel pipe. Water is also brought to this power-house from diversion dams on Marmot and Jane creeks under similar head, connections being made to the same pipe-line.

Beach Power-house

The Beach power-house was placed at an elevation of 165 feet, that water used for power development might, subsequently, be available for use in the concentrating mills. The diversion dam is 30 ft. by 210 ft. and is at an elevation of 1,950 feet. The water is conveyed to the Beach power-house through a pipe-line 14,610 feet long, consisting of 7,700 feet of wood-stave pipe, ranging in size 36, 30 and 28 inches, [illegible]d a steel pipe-line, size 28 and 26 inches, for a distance of 3,710 feet, connect[illegible] with two [illegible]es of steel pipe, each of which has a length of 3,200 feet, in sizes [illegible] and 18 inches. From the 36-inch wood-stave pipe, 6,800 feet from the dam, another

* In 1916, a new mill was completed, the top of which is approximately 1,000 feet from the foreshore and 216 feet above sea-level. The ore after its preliminary crushing inside the mine is conveyed to the receiving bunker of this new mill by means of a narrow gauge railway and a standard gauge incline.

† A small lake, 1,200 feet long by 300 feet wide, at elevation of 4,760 feet, previously considered unimportant as a source of water supply on account of its limited watershed, has been tapped by a tunnel at a depth of 90 feet below the water surface. This water discharges through gates at the tunnel portal and finds its way in a natural bed to Britannia creek above the Park Lane dam.

‡ For summary of equipment in various power-houses see pp. 134-135.

pipe-line, 8,605 feet long, is taken ; this consists of 24- and 18-inch wood-stave pipe, and 15-, 12- and 10-inch steel. It, also, conveys water to the Beach power-house, and an extension of the same line delivers the water, under a head of 1,945 ft., to the Beach compressor house. In addition to the natural stream flow, the water emerging from the Tunnel power-house is conveyed by 24-inch wood-stave pipe, 1,500 ft. long, to a connection with the 36-inch wood-stave pipe on the downstream side of the dam. An additional intake was constructed on Mineral creek during 1915, from which a head of 625 feet is developed. Water is conveyed to the Beach power-house through 2,340 ft. of wood-stave pipe ranging in size from 24 to 10 inches, and 970 feet of 10-inch steel pipe.

At a point on Britannia creek, about 4,570 feet back of the Beach power-house, an intake dam is located,* from which a head of 665 feet is developed to drive two Pelton wheels in the new mill. This pipe-line is continued to the old mill at an elevation of 50 feet, where three Pelton wheels operate under a head of 695 feet.

The Tunnel and Beach power-houses are electrically connected and can be operated in parallel. It is stated that, as mining is carried on in three eight-hour shifts, and the concentrating mills are operated continuously, the load factor is very nearly 100 per cent.

Additional storage reservoirs under construction will almost fully develop the water-power available from Britannia creek and its tributaries.† An auxiliary steam plant, to supplement water-power during dry seasons, has been found necessary. This plant consists of two steam turbines, one unit of 500 k.w. and one of 2,000 k.w.

Canadian Collieries (Dunsmuir), Ltd.

Developments on Puntledge River

The Canadian Collieries (Dunsmuir), Ltd., owns and operates coal mines on the east side of Vancouver island, about 160 miles north of Victoria. Power for its various operations was formerly developed by steam plants at each mine. These plants have now been superseded by a large central hydro-electric installation, with a 13,200-volt distribution system. It is worthy of note that this hydro-electric power apparently has been developed to compete successfully with steam plants situated where coal is available at pit-head prices. It is claimed that considerable economies in operation have been effected.

The Puntledge (or Comox) river drains a lake of the same name situated at an elevation of 420 feet above sea-level. The river is about 9 miles long ; the grade is low for 2½ miles below the lake outlet and then falls 350 feet in about 3½ miles. The watershed above the lake outlet is estimated at about

* During 1916, this intake dam was raised 26 feet, and, to supplement this storage, an additional reinforced-concrete dam, 50 feet by 205 feet, has been constructed about 300 feet back of the intake dam.

†The Britannia Mining and Smelting Co. has acquired the water rights on Furry creek, a mountain stream flowing into Howe sound, about 3 miles south of Britannia Beach. During 1916 foundations were laid in Furry creek for a dam at elevation 880 feet. The system of conveying water to the Beach power-house will consist of sealed tunnels, wood and steel pipe.

250 square miles, but, as its boundaries are not well known, this figure is only approximate.

Storage has been developed on Puntledge lake by the erection of a dam at the outlet. This dam is built on solid rock and takes the form of a buttressed concrete wall 300 feet long. Its crest elevation is 445 feet above sea-level, the discharging gate sill being at elevation 416 feet. The dam raises the water a maximum of 23 feet above the original level. A channel 5 feet deep has been cut in the river bed below the outlet of the lake, thus making it possible to draw the water off below the original level, and a spillway 100 feet long provides, with the gates, discharge capacity in excess of any recorded flood. A log sluice is arranged in the dam by omitting one panel and substituting stop-logs. Six outlet gates, each 5 ft. by 6 ft., are provided.

From the storage dam the water flows in the natural bed of the river for 2½ miles to the diversion dam. The latter is a partially reinforced concrete structure with a spillway 100 feet long, and a concrete intake and gate chamber at one end. There are two gate openings, with gates 6 ft. high by 7 ft. wide. At the diversion dam the water enters a system of canals and flumes 3,400 feet long, in which, due to the broken nature of the country, there are many sharp curves.

The canal traverses solid rock, sand, gravel and clay, and, except for a small portion in impervious clay, is lined with concrete. The canal sections are connected by wooden flumes of semi-circular section. The canal-and-flume line terminates in a short section of reinforced-concrete flume provided with a spillway capable of discharging the total flow. At the entrance to the pipe-line intake structure there is a rotary balanced steel gate of the Taintor type, 12 ft. wide and 10 ft. high. The forebay, or intake structure, is a vertical cylindrical chamber of reinforced concrete, about 25 feet in diameter and 30 feet high. This forms a sedimentation chamber, a blow-off sluice gate being provided. The outlet opening is funnel shaped, decreasing from 12 ft. in diameter to 8 ft. in diameter, a cast iron caulking ring being set in the concrete for connection to the 8-foot wood-stave pipe.

The forebay is 3 miles above the power-house, and the water is carried in enclosed pipes, for the most part of wood-stave construction. The first section consists of one 8-foot wood-stave pipe, 4,500 ft. long, terminating in a Y structure of heavily reinforced concrete, with outlets fitted with gate valves for two 6-foot pipes. The next section consists of two wood-stave pipes, 6 ft. diameter and 4,500 ft. long, only one of which is at present installed. This section ends in a junction structure with inlets for the two 6-foot pipes and outlets for four 50-inch pipes, each of these inlets and outlets being provided with a gate valve. The final section consists of four 50-inch pipes, of which two are at present installed. These are wood-stave for 3,170 ft., and are of steel for the 600 feet next to power-house. The wood-stave pipes are laid in a shallow trench for most of their lengths and are fitted with manholes and air valves where necessary. The junction structures of the pipe-line are of reinforced concrete. Great care was exercised in their design and construction; rich mixtures were used and they were finished inside with cement mortar two to

three inches thick, and several coats of hot asphaltum were applied. The static head is 350 feet.

The power-house is a reinforced-concrete structure, built on a rocky site on the river bank. The present main building provides space for two generating units, provision being made for doubling the capacity. The section of the building containing the switching apparatus and auxiliary plant has been completed for the ultimate contemplated development. The present installation consists of two Escher-Wyss turbines of the reaction type, with multiplied balanced gates controlled by governor. Each turbine is rated at 4,700 h.p.,* and runs at 500 r.p.m. Relief valves are placed on each turbine. The turbines are direct connected to 3,500-k.w., 3-phase, 25-cycle, 13,200-volt, Canadian General Electric Co. generators. The exciters are direct connected, and each is of sufficient capacity for two units. Transmission lines distribute current at 13,200 volts to the various parts of the property, the longest line being less than 6 miles. The substations contain oil-insulated, water-cooled transformers. All large motors operate at 2,200 volts. The smaller motors use current at 440 volts. Power is used for all mining operations, including winding, pumping and ventilation.

The cost of the present development is slightly under $70 per horse-power at the power-house switchboard. When the plant is completed to its ultimate capacity, this low cost will be still further reduced to about $60 per horse-power.

Granby Consolidated Mining, Smelting and Power Co., Ltd.

Development on Falls Creek

The mining and smelting of copper ore is now one of the principal industries of British Columbia. The growth of the industry, which was practically non-existent in 1894, has been remarkable, and, at the present time, more than 60 per cent of the copper exported from the Dominion is mined in British Columbia. Much of this growth is directly attributable to the development of cheap water-power. One of the most recent plants to be completed is that of the Granby Consolidated Mining, Smelting and Power Co., on Falls creek, Anyox.

Falls creek is a small mountain stream, which flows into Granby bay, situated on Observatory inlet, north of Prince Rupert. It drains a watershed of about 40 sq. miles, over which the annual precipitation—a large part of which is snowfall—ranges from 70 to 100 inches.

Storage has been created by a dam about one mile above the mouth, in a rocky cañon 120 feet deep. The dam is a crib-and-rock-structure, with the crest 115 feet above the bed of the stream. A spillway, 120 feet long with crest of 9 feet, was excavated out of the solid rock on the inside of the bend below the crest of the dam. From the dam the water is carried in a 72-inch wood-stave pipe 5,800 feet long, the first 150 feet being in tunnel, the lower end being under a maximum static head of about 300 feet. A steel pipe, 72 in. in diameter and 120 ft. long, connects the wood-stave pipe to the power-house. The w[illegible] head at the power house is 385 feet.

*Maximum capacity 6,000 h.p.

PENDD'OREILLE VALLEY

A heavily timbered watershed of the interior of British Columbia. The Pend d'Oreille river is in the foreground.

ILLECILLEWAET RIVER AND VALLEY

From Observation Point, Glacier. Typical of many streams in British Columbia. The city of Revelstoke is supplied with power and light from this stream.

The power-house is a steel frame structure, with brick curtain walls, built on concrete foundation. The electrical equipment consists of two units, each provided with two water-wheel runners, which are directly overhung upon the main shaft at either end of the alternators. These are Westinghouse 938-k.v.a., 3-phase, 60-cycle, 2,200-volt machines ; the sets run at 400 r.p.m. Two exciter sets are provided, of 50 k.w., 125 volts, 850 r.p.m. ; one set is driven by an induction motor, and one set by an induction motor at one end and a Pelton-Doble wheel at the other.

The power-house also contains air compressors and blowers. The air supply of the main blast furnaces and the smelter is supplied by 3 Connersville positive blowers. Each blower is driven by a direct connected Pelton-Doble wheel, 14 ft. in diameter, 625 h.p., normal rating, but with a maximum capacity of 775 h.p. These sets run at 115 r.p.m. For supplying air to the Bessemer converters, a Nordberg variable capacity, two-stage blowing engine is driven by a Pelton-Doble wheel, 23 ft. in diameter, of 1,400 h.p., running at 75 r.p.m. The Pelton wheel is mounted on the crank shaft and acts as a flywheel. For supplying compressed air for the operation of tools, etc., a Nordberg two-stage compressor is driven by a similar wheel, 16 ft. in diameter, of 800 h.p., running at 84 r.p.m. Each of the above wheels is provided with an oil-pressure governor and relief valves, also with main gate, by-pass valve. The total h.p. installed is about 7,000.

In addition to the above, the power-house contains two Westinghouse motor-generator sets, each of 440 h.p., for supplying direct current to the electric locomotives used for haulage, and to other direct current motors. Alternating current is transmitted to the mine at 2,200 volts. The larger motors are operated at this voltage, while, for smaller motors, the pressure is reduced to 220 volts.

Hedley Gold Mining Co., Ltd.

The Hydro-electric developments of the Hedley Gold Mining Co. provide power and light for the mines and for the town of Hedley.

Hedley Creek Development

The first development by the company was on Hedley creek, a small mountain stream, which joins the Similkameen river at Hedley. A diversion dam, situated about 3 miles from the mouth, diverts water along a 4 by 4-ft. flume, about 13,000 feet long, to a fore-bay. From this point, the water is conveyed to the power-house through two steel pipes, 20 in. diameter. The head developed is 412 feet. One pipe-line supplies water to a 550-h.p. Doble wheel, coupled direct to a 400-k.v.a., 3-phase, 60-cycle, 2,200-volt Canadian Westinghouse generator, speed 150 r.p.m. The second pipe-line supplies water to a Knight wheel driving a Canadian Ingersoll-Rand air compressor, capacity about 3,000 cu. feet of free air per minute. Hedley creek drains a watershed of about 110 square miles, but, being situated in the dry belt, the flow at times becomes very small ; hence, the quantity of power obtained was too uncertain, and had to be supplemented with steam. For this reason, and with an increasing demand for power, the company decided to build another plant on the Similkameen river.

Similkameen River Development

This development is situated about 3 miles below the mouth of Hedley creek. (See Plate 5.) The Similkameen above this point drains a watershed of about 2,000 square miles. As its headwaters lie among the high mountains of the eastern flanks of the Cascade range, the flow, while fluctuating between wide limits, due to the absence of storage, is, nevertheless, far more dependable than that of Hedley creek. Water is diverted from the Similkameen river by a concrete dam with stop-log sluiceways. The adjacent topography does not admit of storage. From the diversion dam, the water is conveyed in 16,000 ft. of flume, 9 ft. wide by 7 ft. deep, to a forebay, and thence through steel pipe, 8 ft. diameter, to the power-house. The static head developed is 67 feet, and it is noteworthy that, in order to develop this head for power purposes, the construction of a flume 3 miles long has been found profitable.

The equipment consists of one 2,100-h.p. S. Morgan Smith Co. turbine of the Francis type, coupled to a 1,250-k.v.a., 3-phase, 60-cycle, 6,600-volt, Canadian Westinghouse generator. The set runs at 400 r.p.m., and has a 25-k.w., direct-connected exciter. Current at 6,600 volts is transmitted 3½ miles to the mill, where the tension is reduced to 2,200 volts—a voltage which enables the two plants to be run in parallel.

City of Kamloops

Development on Barrière River

Kamloops, in 1915, completed the first portion of its hydro-electric development on the Barrière river, which falls into the North Thompson from the east, about 40 miles from the city.

The total drainage area of the Barrière is about 350 square miles. It divides 12 miles above its mouth and both branches have their source in the mountainous district between Adams lake and the North Thompson river. The watersheds are generally well wooded with fir, spruce and cedar, but, in some parts, there is a dense covering of small growth. The snowfall of the district is heavy, and severe weather is occasionally experienced. On both branches of the river there are lakes which afford good storage sites; one of these, Barrière lake, through which the main stream, the North branch, flows, has been utilized for storage for the present development. The area of the watershed above the outlet of the lake is about 135 sq. miles, and Barrière lake has an area of some 3,600 acres. A storage and intake dam has been built at the outlet of the lake, and, from this point, water is conveyed to the forebay in a 5 by 8-ft. flume, 18,000 ft. in length. The forebay is fitted with sluice-gates and provided with spillway. Penstocks, 500 ft. long, convey the water to the power-house, which is situated on the north bank of Barrière river. The head developed is 190 ft.

The present power-house has been built to accommodate four units, two of which are at present installed. Each unit consists of a 1,200-h.p. Francis turbine, manufactured by the Platt Iron Works, direct connected to a 750-k.v.a., 3-phase, 60-cycle alternator, supplied by Canadian Westinghouse Co., generating current at 2,300 volts. These sets run at 720 r.p.m., and are controlled by direct-acting Lombard governors.

The voltage is stepped up to 44,000 volts for transmission to Kamloops. It is anticipated that there will be a considerable demand for power to pump water for irrigation along the North Thompson valley, which is traversed by the transmission line.* The ultimate development possible on the Barrière river is between 16,000 and 20,000 h.p.

To provide against interruption to the hydro-electric service, due to winter troubles or breakdowns on the long transmission line, it was deemed expedient to provide a steam auxiliary plant in the city. As the demand for increased power was urgent, and a steam plant was more easily constructed, it was first completed. The power-house building is situated in Kamloops, near the banks of the Thompson river. It is of reinforced concrete, and contains the pumping plant for the domestic supply to the city. The boiler-room contains four Babcock & Wilcox boilers of 250 h.p. each, designed to operate at 160 lbs. pressure. The turbine-room equipment consists of two Curtis turbo-alternators, of 900 k.w. capacity, built by the General Electric Co. The alternators are 3-phase, 60-cycle, 2,200-volt machines, operating at 3,600 r.p.m. Motor- and steam-driven exciters are provided, also the usual condensing and auxiliary plant. The high tension sub-station receives current from the 44,000-volt lines from the Barrière River plant, and reduces the pressure to 2,300 volts for local distribution. Complete switching equipment is provided.

The city now has at its disposal about 5,000 h.p. of electrical energy. As the demand for power increases, it is intended to increase the capacity of the plant at Barrière river and retain the steam plant as a standby.

The cost of the initial hydro-electric development is about $140 per h.p. ; the installation of a further 4,000 h.p. will reduce the average cost per h.p. to $90, and it is estimated that, when the ultimate development is carried out, the cost per h.p. will be reduced to about $80.

City of Nelson

Development on Kootenay River

The city of Nelson has constructed a hydro-electric power plant at upper Bonnington falls, on the south side of the Kootenay river. This plant supplies light and power to the city and for mining purposes in the adjacent territory.

The site selected for this development was examined and staked at the end of 1900, the water record was granted on January 15, 1901 and the city secured title to the site for the proposed plant January 22, 1903. The plan adopted provided for a plant of four units, each capable of developing 1,250 h.p. under the minimum head of 40 feet† available at high water, or 1,675 h.p. under the 60-feet head† available at low water. Work was commenced April 3, 1905, but, owing to trouble, chiefly in connection with the disposal of the

*During the season of 1917, Kamloops provided electric power for five pumping plants, at a flat rate of $1 per acre per month, the city furnishing the transmission lines and transformers. On another project the owner erected a transmission line, and his rate was 1½ cents per kilowatt-hour.

† The average available head has recently been increased by the improvement of the river channel below the falls, made by the West Kootenay Power and Light Co.

excavated material, the work was held up from time to time. Further delays occurred in the shipment of the plant, and it was not until December 28, 1906, that water was turned on the turbine of the first unit installed.

The power-house is of brick on a concrete foundation. The foundation is raised to the elevation of the turbine floor for four units, but the superstructure is completed for two units only. The present installation consists of two Allis-Chalmers turbines, with a maximum capacity (at highest head) of about 2,000 h.p. each. These are directly connected to Allis-Chalmers 3-phase generators, one of 750 k.v.a. and one of 1,000 k.v.a. The umbrella type of construction adopted enables full advantage to be taken of the total head available at any stage of the water. Speed regulation is secured by oil-pressure governors. Power at 12,000 volts is transmitted 9½ miles on a right-of-way purchased by the city. The transmission line consists of two circuits of stranded aluminium cable carried on cedar poles. The city of Nelson operates its own electric street car service.

Pacific Mills, Limited—Ocean Falls
(Formerly Ocean Falls Co., Ltd.)

Development at Link River

Ocean falls, on Cousins inlet, near the mouth of Dean channel, provides a favourable situation for the docking of ocean steamers of the largest class. The Ocean Falls Co. developed the falls on Link river, which flows from Link lake in a series of rapids, the descent culminating near salt water in Ocean fall.

An intake diversion dam was built above the fall, utilizing the old river channel as a spillway. This dam is of concrete, with a maximum height of 60 feet above the lowest point of the foundation. It is provided with an intake section having two openings, 12 ft. diameter, controlled by sluice-gates for pipe-line connection. From one opening there is a steel penstock 12 ft. in diameter, 1,150 feet long. The lower end of the pipe is parallel to the back wall of the power-house and branches are provided to each water-wheel unit. The head developed is 115 feet. Provision was made for the future installation of a duplicate pipe from the intake to power-house.

The power-house is at sea-level and contains 3 hydro-electric units. The turbines, supplied by James Gordon & Co., are of 900 h.p. each direct coupled to 600-k.w., 3-phase, 60-cycle, 440-volt Westinghouse generators. In addition, there is a 50-k.w. motor-generator set, which supplies power for the monorail system used on the wharves for loading timber, etc. The pulp-grinders are connected in groups of four, each of the six groups being driven by a Francis type turbine of 1,400 h.p., supplied by Jens Orten-Boving. The total capacity of the turbines installed is about 11,200 h.p.

During 1915 the Pacific Mills, Ltd., took over the Ocean Falls Co. and constructed a modern paper mill.

A new dam is being constructed at the site of the old dam and 30 feet higher, which will store water on Link lake to a depth of 25 feet. Link lake has an area of about 10 sq. miles. From this new dam, two 12-ft. penstocks

will deliver water. One penstock will connect with the old penstock and supply the pulp-grinders and the present electric generators; the other will supply water to a new power-house which will contain additional hydro-electric units aggregating 10,000 k.w.*

Powell River Company, Ltd.

Development at Powell River

The largest development, for purely industrial purposes, of water-power situated on the coast, is that of the Powell River Co., Ltd., manufacturing newsprint paper. The company completed a pulp-mill plant in 1911, and considerable extensions have since been made. (See Plate 6.)

Powell river flows out of Powell lake and drains an area of about 600 sq. miles. At the outlet of the lake, there is a natural fall of 140 feet. The lake, which is about 45 sq. miles in area, has been raised about 20 feet above the high water of 1910 by a concrete dam with spillway at elevation of 160 feet above sea-level. A log sluice-way with guide booms provides for the passage of logs over the dam.

Sufficient hydrographic data have not yet been secured from which to determine the ultimate possible development at this site, but it is stated that, when the available storage has been fully utilized, it will conserve the total runoff and maintain a uniform flow. Steel penstocks convey the water to the power-house, which is located at sea-level, with a working head averaging 147 feet.

In the pulp-mill there are two sets of seven pulp-grinders each. Each set is driven by two Allis-Chalmers turbines, of 1,800 h.p. each; also two sets of six pulp-grinders, each set driven by one Platt Iron Works turbine, of 3,600 h.p.; in all, a total of 14,400 h.p. The electrical installation consists of two 3,000 h.p., Allis-Chalmers turbines, each direct coupled to one 1,875-k.v.a., 3-phase, 50-cycle, 600-volt, Canadian General Electric generator, speed 375 r.p.m.; also one Platt Iron Works turbine of 3,600 h.p., direct coupled to a similar generator of 2,500 k.v.a., with speed of 375 r.p.m.—in all making a total of 9,600 h.p. for the generators, or a grand total of 24,000 h.p. developed at the present time.

City of Prince Rupert

Development at Woodworth Lake

Woodworth lake, situated about 7 miles from Prince Rupert, has an area of 500 acres. The watershed area is about 9·5 sq. miles, consisting mostly of steep hillside with very little timber on the upper slopes. The mountains rise to about 4,000 feet. There are several snow-fields, but no glaciers within the drainage area. This project was investigated in 1910-12, and plans prepared; construction work was commenced in January, 1914, and the plant placed in operation in November, 1914.

Investigation of stream-flow revealed a high runoff, and it is anticipated a flow of from 80 to 100 sec.-ft. will be available for power and domestic supply.

*This new plant was installed in 1918, and comprises two 2,500-h.p. turbines and one 5,000-h.p. impulse wheel, direct connected, respectively, to two 1,850-k.w. and one 3,750-k.w., 3-ph., 60-cy., 2,200-v. generators.

A storage dam, 35 feet in height, was built. The power-house is 7,500 feet below the lake, and a head of 330 feet is developed by means of a 45-inch steel pipe 7,800 feet long. The power penstock is also partly used for water supply purposes. Immediately behind the power-house is attached an 18-inch steel pipe-line, 14,000 feet long, which connects with an existing 18-inch water supply pipe near the auxiliary pumping station at Shawatlans lake, about 5 miles from the city.

A power-house of simple design has been erected. The initial installation consists of one water-wheel of 1,650 h.p. capacity, direct connected to a 1,125-k.v.a., 3-phase, 60-cycle, 4,400-volt, at 514 r.p.m., Canadian General Electric generator. Close regulation is secured by oil-pressure governor. A 15-k.w. exciter is connected to the main units. Voltage is regulated by a Tirrell regulator. The energy is transmitted to the city over a single circuit, wood-pole transmission line.

City of Revelstoke

Development on the Illecillewaet River

The Illecillewaet river drains about 480 sq. miles of the western slope of the Selkirk range, and discharges into the Columbia river near Revelstoke. Its valleys and the lower slopes of the mountains are heavily wooded; above the timber line there are numerous snowfields and glaciers. The precipitation in the valley varies from 42 inches near Revelstoke to 58 inches near Glacier, and, over portions of the watershed, no doubt exceeds the latter figure. The winters, with occasional spells of very low temperature and heavy snowfall, are severe and serious ice troubles have been encountered. The river is a typical mountain stream. (See Plate 16.) Its flow varies from about 250 sec.-ft. to over 9,000 sec.-ft.

The Revelstoke hydro-electric development is situated about 1½ miles from the mouth of the river. A concrete dam, 56 feet high, has been built across the cañon, creating a pondage of about 10 acres. Two 6-ft. diameter wood-stave pipes carry the water about 1,200 feet downstream to a power-house, where a head of 72 feet is developed. (See Plate 7.)

The power-house equipment consists of a 900-h.p. Francis turbine, driving a 450-k.v.a. Canadian Westinghouse generator at a speed of 450 r.p.m.; also a 1,400-h.p. Escher-Wyss-Francis type turbine, direct connected to a 750-k.v.a. Canadian Westinghouse generator running at 360 r.p.m. Exciter units in each case are direct connected. Speed regulation of the 1,400-h.p. unit is secured by an oil-pressure governor and of the 900-h.p. unit by a mechanical governor. Current, at 2,300 volts, 3 phase, 60 cycle, is supplied to Revelstoke and to the shops of the Canadian Pacific Ry. To ensure against interruption to service, due to low water, ice, or other causes, a gas-engine auxiliary plant has been provided.

Whalen Pulp and Paper Mills, Ltd.

Development at Swanson Bay

The plant of the Whalen Pulp and Paper Mills, formerly owned by the Empire Pulp and Paper Mills, Ltd., and previously by the Swanson Bay Forests, Wood Pulp and Lumber

Mills, Ltd., is situated in a small bay on the continental shore of Graham reach, a narrow channel dividing Princess Royal island from the mainland, and about 130 miles south of Prince Rupert.

This portion of the coast probably has a heavier precipitation at sea-level than any other stretch of the Pacific littoral. To the southwest, the continuation of the Vancouver range is submerged and, therefore, offers no obstacle to the passage of the moisture-laden winds from the Pacific. The immediate vicinity of Swanson bay is surrounded by high mountains ; those on Princess Royal island are probably of sufficient elevation to start the upward deflection and resultant cooling of the westerly breezes. As a result, Swanson bay has a precipitation similar to that in the higher valleys of the western slope of the Coast mountains. At this station, the average annual precipitation for a period extending over 6 years is 180 inches—the highest recorded in British Columbia.

There is little doubt that future investigation will disclose in this portion of the coast many water-powers easily developed. There are several 'hanging valleys,' occupied by small lakes, situated from one to several hundred feet above sea-level, drained by short creeks, which descend, usually, in gradually increasing grade, with falls or steep cascades near salt water. Swanson creek is ot this type. It drains two small lakes, the lower one of which, about 7 miles long and one mile wide, has been partially controlled for storage. The total head available below this lake is 342 feet, of which 132 feet has been developed, An intake dam, forming a measuring weir, is situated above the first falls. about one-quarter mile from the mouth. A wood-stave pipe conveys the water to the power-house, where S. Morgan Smith Co. turbines are installed aggregating 2,500 h.p. The plant also comprises a sulphite-pulp mill, a large sawmill, and wharves suitable for loading and unloading large vessels. The ultimate capacity of the plant is stated to be about 12,000 h.p.

Western Power Company of Canada, Ltd.

Development on the Stave River

The first application for a water record at Stave falls was made in 1899, by the Stave Lake Power Co., Ltd. In 1909, the Western Canada Power Co. Ltd.,* was formed for the purpose of supplying power, in ample quantity and at prices sufficiently attractive, to encourage the establishment of industries in Vancouver and its vicinity. In June, 1909, the company took over the Stave Lake Power Co. In the same year work was commenced on the present Stave Lake development, and the first unit was placed in commission in January, 1912. (See Plate 5.)

Stave lake lies to the north of the Fraser river, and about 35 miles from Vancouver city. The watershed has only been partially explored. It has an area estimated at about 450 sq. miles, and lies among the granite peaks of the Coast mountains, which, rising high above the timber-line to over 8,000 feet, carry perpetual snow and numerous small glaciers. The total length of the river, from its source in a glacier to its confluence with the Fraser at Ruskin, is about 60 miles.

*Name of Company later changed to "Western Power Co. of Canada, Ltd."

The original elevation of Stave lake was about 230 feet above sea-level, with a fluctuation, between high and low water, of about 15 feet. The lake was 9 miles long by about a mile wide, with precipitous shores to the east and west. From the foot of the lake to Stave falls the river was 7 miles long, with a total fall of 11 feet in about 2 miles of rapids. At the falls and at the rapids in their immediate vicinity the river descended 80 feet. Below the falls, for a distance of 4 miles, there is a series of rapids, and the river finally debouches through a narrow granite gorge into the Fraser river.

The present Stave Lake development utilizes the head available in the immediate vicinity of the falls and also the head concentrated at that point by a dam, which drowns the rapids above and the large areas of low land at the head and the lower end of the lake. The working head varies between 100 feet at low-lake level and 120 feet with full reservoir. Very careful preliminary investigation was made of hydraulic conditions. This included extensive surveys, measurements of water supply, precipitation, flood conditions, etc. The results of this investigation are ably summarized in a paper presented by Mr. R. F. Hayward before the Canadian Society of Civil Engineers.*

The raising of the level of Stave lake materially increased its area. At a stage of 269, the lake extends for 18 miles above the dam, and its area at this stage is about 24 sq. miles. This reservoir will have a storage capacity of nearly 370,000 acre-feet, sufficient to maintain a mean flow of about 3,150 sec.-feet in lowest years yet recorded and somewhat more in average years. The average flow over a number of years has been about 4,000 sec.-feet, but the physical conditions at Stave falls are such that it is not economically feasible to build a dam to an elevation of about 300 feet, which stage would be required to completely store the mean flow over the years of record. The most economical height of dam is that which would maintain a flow line at elevation of about 264 feet above sea-level.

In its natural state the main river divided into two branches about 400 feet above the falls, re-uniting about one-half mile downstream. The intake and sluice-dams have been built at the head of the falls. The power-house is built across the western channel, below the intake dam, and the eastern channel is utilized for the overflow and flood discharge from the sluice-dam. When the lake is raised to the ultimate elevation proposed, the present sluice-dam—now designed to take practically the whole flood discharge of the river—will be built up solid, with a row of gates on top for partially controlling the flood discharge, and the main flood discharge will pass down an old channel, about one-quarter mile to the east of the falls, known as the Blind slough. For a flow-line at elevation of 239 (sea-level) the Blind slough forms a natural rock spillway-dam 400 feet long, with a channel 50 feet wide and 20 feet deep at one side. The deep portion is at present closed by a timber crib-dam, and a temporary spillway of low elevation is built across the remainder of the channel. The permanent structure will consist of concrete piers, with log sluices, and will make ample provision for flood discharge.

* "The Stave Falls Power Development of Western Canada Power Company, Limited," by R. F. Hayward, M.E.I.C. Read Oct. 7, 1915. In *Transactions of the Canadian Society of Civil Engineers.*

Photos Courtesy Professor C. B. Sissons

SNOW STORAGE IN THE SELKIRKS

Crevasse showing section through successive seasons' snow layers. The narrow band is about 2.5 feet thick and represents the snow-fall of the winter 1911-1912, the other bands range from about 5 to 7 feet in thickness. (Photograph taken August, 1915).

STORAGE IN GLACIERS

From a shoulder of Mount Moloch, looking south to the source of the main branch of Downie creek, a tributary to the Columbia, about 35 miles north of Revelstoke. Note the well-formed medial moraine.

The sluice-dam is 150 feet wide, built of reinforced concrete. The piers are 8 feet wide, with five stop-log openings, each 22 feet wide. The intake dam is of concrete on a granite foundation. It is 160 feet long and, when completed, will be 70 feet high. There are four main intakes, with necessary screens. The intake gates are of the radial type and weigh 23 tons each. In addition, there are two gate chambers for pipes to the exciter units.

The main penstocks are 14 ft. 6 in. diameter. The upper ends are imbedded in the concrete and belled out to 19 feet, giving a maximum velocity at the mouth of 4·6 feet per second, and in the pipes of 8 feet per second. There are two separate 46-inch steel penstocks for the exciter units and oil pumps. The penstocks are not more than 150 feet long, thus securing excellent regulating conditions. The tailrace, 1,500 feet long, was excavated to a depth of about 30 feet.

The power-house, constructed of reinforced concrete on solid rock foundation, was designed for four main units, but first completed for two, with the necessary auxiliary equipment.* Each main unit consists of a 13,000-h.p., double horizontal turbine of the Francis type, built by the Escher-Wyss Co., of Zurich, Switzerland, direct coupled to a 9,000-k.w., 3-phase, 60-cycle, 4,400-volt Canadian General Electric generator. There are two exciters, each 250 k.w., 125 volts, driven by its own turbine, and each capable of exciting four machines. Regulation is secured by governors of the oil-pressure type, the oil pumps being driven by individual impulse wheels.

The current is stepped up to 13,000 volts and 60,000 volts, and, at the higher tension, is transmitted 32 miles to Ardley, a point about midway between Vancouver and New Westminster. Another line runs south to the international boundary, where it connects with a line built by the Puget Sound Traction, Light and Power Co. into Bellingham, the total distance being 47 miles. At 13,000 volts the current is transmitted to points within 20 miles of the generating station.

From the tailrace of the existing plant to the mouth of the river, an additional fall of 130 feet is available. Two plans of developing this fall have been considered: One plan contemplates a concentration of the head at the narrow gorge near the mouth by the construction of a dam 165 feet high. The second plan provides for two dams, each 65 feet high, one at the above gorge, and one about a mile below the present plant. The latter plan involves less initial expenditure, and would enable the plant capacity to be increased by stages with the increasing demand until ultimately turbines aggregating some 120,000 h.p. had been installed. This would complete the development of the Stave river.

West Kootenay Power and Light Co., Ltd.

The West Kootenay Power and Light Co., Ltd.—a pioneer in the development of water-power on a large scale in British Columbia—owns and operates three hydro-electric generating plants. Two of these are at Bonnington

* In 1916, the building was extended for the installation of the third and fourth units. The third unit is now running, and the intake gate and penstock have been erected in preparation for the installation of the fourth unit.

falls, on the Kootenay river (see Plate 15) and the third is situated on the Kettle river, about twelve miles below Grand Forks.

These developments are the largest and most important in the interior of British Columbia, and furnish power and light to the cities of Trail, Rossland, Grand Forks, Phoenix, Greenwood, Boundary Falls, and to other users within the radius of the transmission lines.

In 1897, the gold and copper mining industries in the Kootenay country were practically undeveloped. At that time a small smelter was in operation at Trail, and mining operations were in progress at Rossland, but the total amount of energy utilized at these two points probably did not exceed 1,000 h.p. In this section of British Columbia, the mines and smelters are the largest consumers of power, and, today, the connected load in the vicinity of Rossland alone has increased to over 6,000 h.p. The great development of the mining and allied industries has been largely facilitated by the supply of power made available by the developments of the Kootenay Power and Light Co.

Plant No. 1, Lower Bonnington Falls

The first plant, now known as Bonnington Falls plant No. 1, was commenced in 1897. It is situated at Lower Bonnington falls, and has a capacity of 4,000 h.p. under a normal working head of 34 feet. The equipment consists of three units : one turbine unit of 2,000 h.p., direct connected to one generator of 1,500 k.w., and two turbine units of 1,000 h.p., each direct connected to generators of 750 k.w. The turbines are twin runners of the horizontal type. The generators are 3-phase, 60-cycle. The sets run at a speed of 180 r.p.m. Current is generated at 1,100 volts and stepped up to 22,000 volts.

Plant No. 2, Upper Bonnington Falls

Plant No. 2 is situated at Upper Bonnington falls, a short distance above No. 1. The power-house is of reinforced concrete, situated in the channel immediately below the falls, on the north side of the river. The building and intake structure form a wing-dam, which diverts the water to the turbines. The head developed is 63 feet at low-water stage, but, during high water, it is reduced to 56 feet by backwater caused by the contracted area of the channel a short distance below the falls. The working head, it is estimated, may be increased to 70 feet by the removal of obstructions in the channel below, and the erection of a low dam across the river above the falls. This work is now under way.*

Space in the power-house provides for four main generating units, two exciter units, and the necessary transformers and switching apparatus. The main units, all of which are now installed, consist of two 8,000-h.p. Francis turbines, with vertical shaft, each direct connected to a 5,625-k.v.a., 3-phase, 60-cycle, Canadian General Electric generator of the umbrella type, and two 9,000-h.p. Francis turbines with vertical shaft, each direct connected to similar

* The charter of the West Kootenay Power and Light Co. (granted in 1905) permits the construction of a dam across the Kootenay river, commencing at their own forebay and extending to connect up to the forebay of the plant of the city of Nelson. In this connection some conflict of interest arose between the power company and Nelson, which difficulty, however, was satistorily adjusted (see order of the Comptroller of Water Rights, B.C., of Feb. 23, 1917). The dam was constructed during the autumn of 1916 and spring of 1917. During construction, special gauges were installed to record the effect of the dam at high stages. For further information consult Water Rights Branch, Victoria.

generators of 7,500 k.v.a. The sets run at a speed of 180 r.p.m., and regulation is by oil-pressure governors.

Current is generated at 2,200 volts, and stepped up to 60,000 volts, at which it is transmitted to sub-stations at Greenwood, Rossland, Grand Forks, Phoenix and Boundary Falls—the last named being 84 miles from Bonnington. At No. 2 station there are also step-up transformers, from 2,200 volts to 22,000 volts. This enables plants Nos. 1 and 2 to be run in parallel for transmitting power to Rossland, Trail, Nelson and Silver King mine. The longest distance over which current at this voltage is transmitted is 32 miles.

Plant No. 3, Kettle River

The Kettle River plant, known as plant No. 3, or the Cascade plant, is situated on Kettle river, about 12 miles below Grand Forks. At this point, the river flows through a gorge, with a series of rapids and falls, providing a natural head of 120 feet in a distance of about one-half mile. A dam at the head of the gorge raises the water level some 36 feet. From the dam, the water is conveyed by 700 feet of open-rock cut and 400 feet of tunnel, to the pipe-line intake; thence to the power-house in a steel pipe 7 feet in diameter. The head developed is 156 feet.

The generating equipment comprises three units, each of a 1,300-h.p. turbine, consisting of two 39-inch horizontally mounted runners, direct connected to a 750-k.v.a., 3-phase, 60-cycle, Canadian Westinghouse generator. Speed of the units is 400 r.p.m., and control is by Escher-Wyss mechanical governors. Two 45-k.w. exciters are provided. Current is generated at 2,200 volts and stepped up to 22,000 volts for transmission to substations at Grand Forks, Phoenix, Greenwood and Boundary Falls, the last named being 28 miles from No. 3 plant.

Some Proposed Power Developments

Proposed Bridge River Diversion

Among the various proposals for water-power development, that for the diversion of Bridge river (tributary to the Fraser at Lillooet) to Seton lake is worthy of special mention. Briefly, the proposal is to divert the water of Bridge river, at a point above the head of the cañon, by means of a tunnel about 2½ miles long, to Seton lake. The difference in level between Bridge river, at the proposed point of diversion, and Seton lake is about 1,240 feet, from which it should be possible to obtain a working head of over 1,150 feet. A good dam-site exists near the head of the cañon. (See Plate 24.) Plans have not yet been fully worked out, but it has been established that the grade of the river above the cañon is only about 3 feet per mile for 3 miles and probably does not exceed 7 feet per mile for 20 miles. It is further stated that a dam 100 feet high would give storage of 50,000 acre-feet.

The watershed above the proposed diversion is about 1,900 sq. miles, and the upper waters drain the eastern slope of the Coast mountains. In the winter, the low-water flow falls at times to less than 500 sec.-ft., but extreme low-water conditions do not prevail for long periods, as the cold is not steady and rain frequently occurs during the winter months. Available stream-flow measurements suggest that, with only the one dam as an initial development,

a low-water flow of about 1,000 sec.-ft. might be maintained, which, under a head of 1,150 feet, would develop over 100,000 h.p. Other storage possibilities are said to exist higher up Bridge river and on some of its tributaries. When these are fully developed, an even greater flow might be maintained. It is evident, therefore, that this power possibility is one of considerable magnitude.

Proposed Development at Campbell River, V.I.

Campbell river has the largest undeveloped power on Vancouver island. There is a series of falls situated on the river between Lower Campbell lake and the mouth. The elevation of Lower Campbell lake is about 542 feet above sea-level, of which probably 450 feet head can be developed for power.

Campbell river, above the outlet of Lower Campbell lake, drains an area of 550 to 600 square miles, a large part of which lies within the confines of Strathcona park. Excellent storage might be created by dams at the outlets of Buttle lake, area 7,180 acres ; Upper Campbell lake, area 1,350 acres, and Lower Campbell lake, area 2,200 acres. Even in their natural state these lakes exercise a considerable control over the stretches of stream below them. Glaciers and snowfields at the headwaters assist in maintaining the flow in the summer months.

Various projects have been suggested for the development of the latent power of this river. One proposed the placing of a dam at the outlet of Irene pool, at elevation 405 feet, and driving a tunnel to a point on the river bank, from which a short steel penstock would convey the water to a power-house situated below the last box cañon near the western line of lot 63. This would give a head of 325 feet. Another plan contemplated the erection of a dam immediately west of the second fall, and, by flume and tunnel, carrying water to the same power-house site, giving a head of 155 feet. In both projects a large portion of the head available below Lower Campbell lake would not be utilized ; and besides, in order to secure storage, it would be necessary to build an auxiliary dam at the outlet of Lower Campbell lake.

A third plan is as follows : Near the southeasterly angle of McIvor lake, a narrow ridge divides the Campbell watershed from the Quinsam valley. A short tunnel would lead the waters of McIvor lake, which is at practically the same level as Lower Campbell lake, through this ridge to sustaining ground for an open channel. The channel might be continued in good ground to a point where a forebay could be constructed, with a penstock to the same power-house site as before. This would utilize a head of over 450 feet. Storage might be developed on Lower Campbell lake by a dam at the present outlet.

Instead of building a dam at the outlet of the lake, it might be built in a cañon about a mile below the outlet and at the top of the 30-ft. fall. Thus, it would be possible to develop a head of about 50 feet, which could be utilized for a preliminary plant located below the 30-ft. fall. This dam would regulate the level of Lower Campbell lake and form the initial work for the later development of the larger project outlined above.

Sufficient records are not available to enable a close estimate to be made of the precipitation on the watershed ; records kept near the mouth of Campbell

river indicate an average annual precipitation of over 50 inches ; but the upper portion of the watershed is very mountainous, and the average precipitation over the whole would probably exceed 80 inches annually.

Gauge records have been taken by the Campbell River Power Co. for some years. Recent measurements have enabled the gauges to be rated, and the valuable records of stream flow are incorporated in the stream flow tables.

The runoff from the watershed is fairly well distributed throughout the year and, with a full utilization of the storage available, a flow of from 2,000 to 2,500 sec.-ft. might possibly be maintained, except for short periods. At 450 feet head and 80 per cent efficiency, the latter flow would develop about 100,000 horsepower. For view of Elk fall on Campbell river see Plate 28.

Proposed Development on Shuswap River by Couteau Power Co.

The site of the initial and main power plant, as contemplated in connection with this proposed development, is at Shuswap falls, situated 10 miles above Mabel lake and 26 miles due east of Vernon. The drainage area above Shuswap falls is estimated at from 600 to 800 square miles and is plentifully wooded. Precipitation records have been taken at several nearby places. At Vernon, 20 years' records give an average of 14·48 inches; at Enderby, 16 years' records give 20·29 inches. The Couteau Power Co. has taken records at Shuswap falls for three years, and at the head of Sugar lake for a shorter period, recording an average of 18·76 inches at the former station and about 32 inches at the latter. For details see tables. During the winter of 1911-12 the greatest accumulated depth of snow averaged from 3½ feet at Shuswap falls to 6½ feet at Sugar lake. At the former place, the ground was bare of snow on April 7 and, at the latter, on April 20. It will be noticed that the precipitation increases towards the headwaters. Ice conditions seem to be at their worst between the third week in December and the second week in February ; anchor ice forms all along. In many places it bridges the river, and at times there is a continuous flow of frazil. Sugar lake is usually frozen over from the early part of January till the end of March.

Storage constitutes an essential feature of this development. Local storage will be secured by means of the intake reservoir, which will extend four miles upstream from the dam, while Sugar lake will provide storage for the full development. For view of site of intake dam, see Plate 21. Sugar lake, at an elevation of 2,080 feet above sea level, has an area of 3,768 acres, and is 4½ miles long by 2¼ miles in the widest part. It is fed by several creeks and supplies about 75 per cent of the discharge at Shuswap falls. Apart from a small area of flat land at each end, the shore rises quickly and is densely wooded. After a fall of 38 feet at the lake outlet, the river flows at an even grade for 20 odd miles to the gorge above Shuswap falls, where it descends 70 feet in a series of rapids extending over one-half mile. Special stream flow and other studies, under the direction of the consulting engineer, Mr. A. R. Mackenzie, have been made at Shuswap falls and Sugar lake. These results are summarized in the tables and are shown graphically on Plate J.

The company's plans contemplate development in four stages, as increased demands arise for power. The first stage, with intake dam and one 8-foot diameter penstock, 3,750 feet long, to power-house, will develop a head of 130 feet at Shuswap falls and provide 4,000 continuous h.p., with a peak capacity of 7,600 h.p. The second stage will duplicate the pipe-line at Shuswap falls and provide storage by raising the level of Sugar lake 18 feet; this will make the total supply available 8,000 continuous h.p., with a peak capacity of 13,250 h.p. The third stage provides for three 8-ft. penstocks from intake dam to power-house, and increases the storage by raising the surface of Sugar lake to 40 feet; this will bring the supply up to 12,000 continuous h.p., with a peak capacity of 19,880 h.p. The fourth stage provides for an additional plant at the foot of Sugar Lake dam, operating under a head of 70 feet, the water being again utilized at the Shuswap Falls plant, 20 miles lower down the valley. It is estimated that the two plants will yield a total of 18,000 continuous h.p., with a peak capacity of 28,880 h.p. The dam at Sugar lake will be designed to allow of an eventual increase of height to 80 feet, which, with the provision of additional equipment at both power-houses, would further increase the available power.

Jones Lake Proposed Development

Jones lake is only 1,260 acres in area and drains a watershed estimated at about 25 square miles, most of which is at an elevation of over 3,000 feet. It is at an elevation of 1,950 feet and is 6 miles above the confluence of its outlet stream, Jones creek, with the Fraser. The proposed diversion, however, will not follow the valley of Jones creek, but will pass, by means of a tunnel about 10,000 feet long, from the westerly side of the lake through the mountain, and then by a pipe-line, 6,000 feet long, to a power-house in the Fraser valley. Precipitation records have been kept since 1910, showing a total precipitation of over 80 inches per annum (see tables). The runoff has also been measured. In addition to the flow of Jones creek, there is a small tributary entering 300 yards below the lake; this tributary, known, locally, as Boulder creek, and having a runoff of about one-fifth that from Jones lake, can easily be diverted into Jones lake. (See stream flow data for Jones and Boulder creeks.) By raising the lake 50 feet, a storage of 89,000 acre-feet can be secured. The working head would be over 1,800 feet, and it is stated that there will be available, when fully developed, 25,000 horsepower.

Proposed Development on Mesliloet (Indian) River and Tributaries, Burrard Inlet

A development of considerable interest is that contemplated on the Mesliloet river. It is proposed to store water in several small lakes situated high up in the mountains at the headwaters of a number of its tributaries. Water will be carried by means of flumes to a forebay 2,000 feet above the power-house, and steel penstocks will convey the water to a common power-house near the mouth of Hixon creek. Details have not yet been fully worked out, but

it is suggested that storage can be developed on these creeks sufficient to conserve the whole run-off and ensure a uniform flow. In connection with this it is also proposed to develop 450 feet on Mesliloet river, the water being conveyed by flume and penstock to the same power-house. (See Plate 32.)

Possible Developments in Vicinity of Prince Rupert

Two possible power developments near Prince Rupert have been carefully examined by Messrs. Ritchie, Agnew & Co., one at Khatada river, and the other at Falls river. These are on adjacent watersheds.

The Khatada river drains lake Brutinel and flows into the Skeena river, 42 miles from Prince Rupert.

The Falls river is a tributary of the Hocsall river and enters it 18 miles above its mouth. The Hocsall river, which is tidal and navigable to the mouth of Falls river, joins the Skeena near its mouth at Port Essington. The mouth of Falls river is about 45 miles from Prince Rupert.

The drainage areas of the Khatada and Falls rivers have been determined by instrumental survey. This was a difficult survey, because several of the mountains on which the stations had to be erected were over 5,000 feet in elevation, the highest being 6,240 feet. Snow-fields and glaciers had to be crossed, and alpenstocks and lifelines were freely used. The weather conditions were often very trying; fog and mist made observations of distant stations, at times, impossible.

Falls River

The drainage area of Falls river was found to be 88·96 sq. miles or, including the drainage area of lake Haywood, which can be diverted to Falls river, 90·9 sq. miles. The major portion lies at an elevation exceeding 3,000 feet. Falls river, in one chute, descends 175 feet, into a basin which is flooded at high tide. Above the falls, the valley is narrow and affords an excellent dam-site. Above the dam-site, the river only rises 25 feet in a distance of 4 miles, the valley widens out, and there are large beaver meadows and flats, constituting a storage basin. Contours were taken, and it was found that a dam with crest elevation of 285 feet (average elevation of high tide being 20·76 feet) and allowing the water to be drawn down to elevation of 235 feet, would give sufficient storage to conserve the total run-off and maintain a flow of about 750 sec.-ft. A careful analysis of the head obtainable, taking into consideration the average heights of reservoir and tide-water, and allowing for losses, gave an average effective head of 245 feet. This, with 750 sec.-ft. and 80 per cent efficiency, would yield 16,700 continuous h.p., or, with a 60 per cent load factor, an installed capacity of 27,830 h.p. The 750 sec.-ft. is regarded as conservative and is based on a careful analysis of records of flow taken in a year when rainfall was below the average. It will be seen from the tables that the run-off was 8·44 sec.-ft. per sq. mile.*

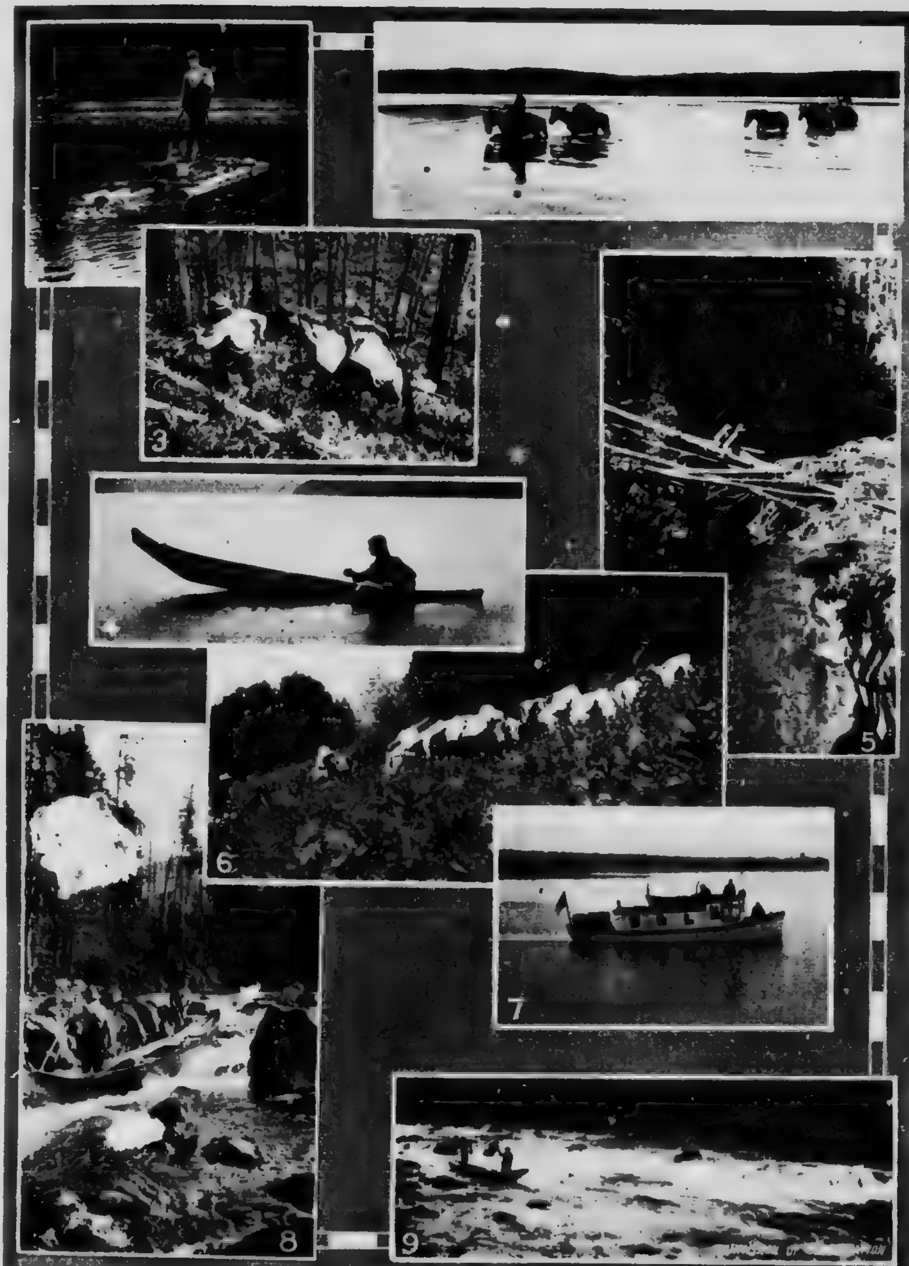
* These estimates of power for Falls and Khatada rivers were supplied by the engineers, and are based upon their investigations and knowledge of governing factors. It may be observed that these estimates differ but little from those presented in the power-site tables.

Khatada River

The Khatada river drains 60 sq. miles. Rainfall and runoff measurements have been taken at the Khatada valley for one year, from Dec. 7, 1911, to Dec. 6, 1912. The total precipitation during this period was only 77·39 inches, which is considerably less than the usual rainfall in the district. Conclusions based on this year should, therefore, be conservative. The total average continuous runoff was equal to 330 sec.-ft., or 5·52 sec.-ft. per sq. mile. See stream flow data, Khatada river.

The present elevation of lake Brutinel is 345 feet. The Khatada river falls 10 feet at its outlet and 270 feet in 12 miles of rapids and falls below lake Davis. There is a good dam-site of solid granite some distance below lake Davis, and it is proposed to raise the elevation of the two lakes to 370 feet. This would give sufficient storage to conserve the total runoff and maintain a flow estimated at 330 sec.-ft. The working head will be about 350 feet, giving, at 80 per cent efficiency, a continuous 24-hour power of 10,500 h.p., or, with a 60 per cent load factor, an installed capacity of [illegible],500 h.p.*

*See footnote p. 175.



INCIDENTS OF TRAVEL AND INVESTIGATION

1.—An improvised raft.
2.—The Long ford, Francois lake.
3.—Hard packing.
4.—Sometimes there is no choice in canoes.
5.—Crossing Ice river cañon, the easy way down.
6.—Packing up a hillside, Skeena district.
7.—Outward bound. The 'Lizette' leaving Victoria.
8.—The frequent rapids are troublesome for the canoe.
9.—'Poling up' is often the best method.

CHAPTER VIII

Surveys and Maps of British Columbia

Including a Reference to Range of Tidal Levels

OWING to the rugged and inaccessible character of much of the area of British Columbia, the making of provincial surveys has been a slow and costly undertaking.

In engineering projects involving a consideration of the regimen and amount of water supply, a knowledge of the extent and physical characteristics of tributary watersheds is of basic importance. Below is a summary of all available maps* and a short description of the surveys upon which they are based.

Pacific Coast Surveys

The history of the mapping of the British Columbia coast practically begins with the surveys of Capt. James Cook, R.N. In 1778, when in command of the *Resolution* and *Discovery*, he examined portions of the western coast of North America from 44° N. to the Arctic regions. He discovered and named Nootka sound, Vancouver island.

In 1791, Capt. George Vancouver, who, on Cook's voyage, had been a midshipman in the *Discovery*, was sent from England in command of an expedition, consisting of H.M.S. *Discovery* and the armed tender *Chatham*. He was instructed to make extensive exploratory surveys to determine the existence, or non-existence, of the Northwest passage. This work, which was performed during 1792, 1793 and 1794, was so detailed and so accurate that Vancouver's surveys of several inlets are still incorporated in the latest Admiralty charts.

Between 1794 and 1857, there were only isolated surveys of certain channels and harbours, such, for example, as those made in the summer of 1846 by Capt. Henry Kellett, in the *Herald*, accompanied by Lieut.-Com. James Wood, in the *Pandora*. In 1857, further extensive survey work was undertaken under Capt. (afterwards Admiral Sir) Henry Richards, in the *Plumper*—later replaced by the *Hecate*.

In 1863, Capt. Richards returned to England in the *Hecate*. Mr. Daniel Pender, R.N., formerly master of the *Hecate*, continued the survey from 1863 to 1870, in the *Beaver*, which he hired from the Hudson's Bay Co. Associated with Richards and Pender were Lieuts. Richard Charles Mayne, John Augustus Bull, and others. Many names of the officers of the surveying parties and survey vessels are perpetuated in geographic features along the Pacific coast.†

From 1874 to 1879, surveys and examinations were made of several of the inlets along the coast, to determine their suitability for harbours or ter-

* Consult also: *Catalogue of the Maps in the Collection of the Geographic Board* and *Geographical Index* to same. Geographic Board of Canada. Ottawa, 1918.

† See *British Columbia Coast Names, 1592 to 1906, their Origin and History*, by John T. Walbran, 8vo., 546 pp., with map and illustrations, Ottawa, 1909.

minals in connection with the proposed Canadian Pacific railway. In 1878, Dr. G. M. Dawson, Assistant Director, Geological Survey of Canada, made an examination and sketch survey of the east coast of Moresby island and Masset inlet. In October, 1898, H.M.S. *Egeria* arrived from England, in charge of Com. Morris H. Smyth, and, under various commanders, has been employed in survey work on this coast.

The following is a list of some of the more comprehensive charts of the British Columbia Pacific coast :*

MAP LIST No. I

Admiralty Charts of the British Columbia Coast

No. of chart	Title of chart †	Scale ‡	Net price
			s. d.
2430	Queen Charlotte islands and adjacent coast of British Columbia..	10m. to 1 inch	2 0
1923a and 1923b	Cape Caution to Port Simpson, including Hecate strait and part of Queen Charlotte islands—northern portion, 3/0 ; southern portion, 4/0	5m. " "	7 0
2449	Lama passage and Seaforth channel	0·625m." "	4 0
1917	Vancouver island and adjacent shores of British Columbia	10m. " "	3 0
582	Goletas channel to Quatsino sound, including Scott islands	2m. " "	3 0
581	Johnstone and Broughton straits and Queen Charlotte sound with Knight inlet and adjacent channels	2m. " "	4 0
2870	Toba, Bute and Loughborough inlets and adjacent channels	2m. " "	3 0
580	Strait of Georgia—Sheet 2 : Northeast point of Texada island to Johnstone strait	2m. " "	3 0
579	Strait of Georgia—Sheet 1 : Fraser river to northeast point of Texada island, including Howe sound and Jervis inlet	2m. " "	4 0
2689	Juan de Fuca strait to strait of Georgia	2m. " "	3 0
1922	Fraser river and Burrard inlet	1m. " "	4 0
3618	Moresby passage to Gabriola pass—northern sheet	0·56m. " "	3 0
3619	Moresby passage to Gabriola pass—southern sheet	0·56m. " "	3 0
2840	Haro and Rosario straits	1·1m. " "	4 0
584	Sydney inlet to Nitinat, including Clayoquot and Barkley sounds	2m. " "	3 0
569	Esperanza to Clayoquot, including Nootka sound	2m. " "	3 0
583	Quatsino to Esperanza, including Kyuquot sound	2m. " "	3 0
2458	Port Simpson to Port McArthur, including inner channels, and Prince of Wales island	5m. " "	4 0
2431	Port Simpson to Cross sound, including the Koloschensk archipelago	10m. " "	4 0

Tides on Pacific Coast

In designing water-power installations for situations within the range of tidal influence, a knowledge of the fluctuation of sea-level at the site will, at times, be necessary.

* A full list of the various Admiralty charts of British Columbia waters will be found in *Catalogue of Admiralty Publications* (see section XIII), issued by Potter, Minories, London, Eng., or a copy may be consulted at their agencies in Vancouver and Victoria. An Index Map to these charts is published in the *British Columbia Pilot*. Charts of British Columbia waters are also published by the Hydrographic Office of the United States Navy. A list of these charts, the majority of which are based on British surveys, is given in Section IV of the *General Catalogue of Mariners' Charts and Books* (revised periodically), Washington, D.C.

† Most of the charts have detail plans to a larger scale of the more important harbours, anchorages, bays, inlets and narrows.

‡ The scale is given in geographical or nautical miles to 1 inch. *Note* : As corrections and additions are frequently made to the charts, those applying for them should request copies embodying the latest corrections.

The Tidal and Current Survey Branch of the Naval Service, under the direction of Dr. W. Bell Dawson, has, especially since 1905, been conducting investigations respecting the regimen of the tides along the Pacific coast of British Columbia.

The Tidal Survey has established automatic recording tide gauges at a number of stations along the coast.* The table of tidal ranges (p. 180) and the list of bench marks in Appendix II will be of special assistance to persons interested in developments at or near tide-water. Where however, matters of special issue are involved, interested parties are recommended to communicate directly with Dr. W. Bell Dawson. When writing, the applicant should supply, in a clear and concise form, all available information. For instance, for a portion of the coast for which data are required and where no permanent station is maintained, tidal readings for only a few days, *if accurately recorded with respect to time*, may enable the Tidal Survey, with the aid of their records for other stations, to set forth the specific characteristics of the tide observed, including its probable extreme ranges at the place of observation. Wherever possible, the observations should be made with reference to a permanent bench mark.

High and low water may be approximated as follows : High-water mark may usually be determined, with fair approximation, from markings upon the shores. With respect to low water, the small publication, *Tide Levels and Datum Planes on the Pacific Coast of Canada*,† contains a list and description of about 35 bench marks employed by the Admiralty in connection with their hydrographic surveys to fix the low-water datum to which chart soundings are reduced. From these data average low water may be deduced.

On the open Pacific coast, the tide curve is fairly regular, though showing a strongly marked diurnal inequality, especially northward, and the springs and neaps can be distinguished with little difficulty. In the region of the strait of Fuca and the strait of Georgia, however, the tides are of quite a different character, and here it is difficult to distinguish the springs and neaps.‡

Mean sea-level, as used by the Tidal Survey, is the mean ordinate found by the integration of the tidal curve referred to any selected invariable base line or datum. When so defined, mean sea-level should clearly be differentiated from half-tide level ; that is to say, half way between extreme high tide and extreme low tide does not necessarily coincide with mean sea-level as above defined. On the Pacific coast, in the case of a tide whose extreme range is

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* A list of stations and observations upon which the tidal information is based, will be found at pp. 57-59 of the *Tide Tables for the Pacific Coast of Canada, for the year 1911*, Ottawa, 1910. "As the accuracy of the tide tables is represented by the length of the tidal observations on which they are based, those for Clayoquot, Victoria, Sand Heads, Vancouver and Port Simpson are now superior to the tide tables for any port on the Pacific ocean, in America, Asia or Australia. The tide tables for Prince Rupert are now equal to those for San Francisco, which are based on the longest record of any that are published for the Pacific coast, by the United States Coast Survey." See *Tide Tables* (Introduction).

† Pp. 16-21 ; (Dominion *Sessional Papers* No. 21c., 1906).

‡ For discussion of these special tidal manifestations, see p. 63 of *Tide Tables for the Pacific Coast of Canada for the Year 1918*, Ottawa, 1917.

only 13 feet, the half-tide level may differ by as much as a foot from true mean sea-level. In Juan de Fuca strait and the strait of Georgia, the mean sea-level is at greater elevation than the half-tide level. This is explained by the fact that, during the greater part of the day, the 'high waters' prevail at about the same general level—there are only relatively slight fluctuations near the high water level, but, once a day, there is a sharp and short drop to the lower water level. This stronger characteristic of the tides obscures the usual feature of spring and neap tides, and hence, for the region of Juan de Fuca strait and the strait of Georgia, the table presented in the *Tide Tables* gives only the *mean* rise. This mean rise in certain localities is as follows :*

TABLE OF MEAN TIDAL RANGE

	Mean rise
Juan de Fuca strait........................	8·3 to 9·3 feet
Gulf islands, off strait of Georgia.............	9·3 to 12·6 feet
Strait of Georgia..........................	11·5 to 14·1 feet
Channels northeast of Vancouver island	10·2 to 13·9 feet

On the open Pacific coast representative ranges of tidal levels are as follows:

TIDAL RANGE ON OPEN PACIFIC

Locality	Rise of tide	
	Springs	Neaps
	Feet	*Feet*
Vancouver Island West Coast—		
Port Renfrew—San Juan bay	9	7
Carmanah point	10	7½
Port Alberni	10½	8
Clayoquot	11	8
Nootka sound	12	9
Quatsino sound	11	8
Northern Coast of British Columbia—		
Rivers inlet	14	11
Bellakula, head of Burke channel	16	13½
Ocean Falls, Cousins inlet	15	11½
Swanson bay, Graham reach	13	9
Kitimat	13½	10½
Port Essington	21	15½
Port Simpson	20	14½
Nass river at Mill bay	21	17
Observatory inlet	21	15½
Stewart, head of Portland canal	22	17
Queen Charlotte Islands—		
Juskatla bay, head of Masset inlet	7	5½
Masset harbour, at Indian village	9½	7
Skidegate inlet, at Queen Charlotte	17	14
Lockeport, on West coast	16	13

Note—The range of the tide at the heads of the long inlets on the coast is only from 2 to 12 per cent greater than at their mouths.

* The data here given have been abstracted from the Tide Tables for 1918. For more detailed information consult *Tide Tables for the Pacific Coast of Canada*, issued annually by the Tidal and Current Survey, Department of Naval Service, Ottawa ; also *The British Columbia Pilot*, published by the Admiralty, 8vo, 596 pp., London, Eng.; also Admiralty charts.

Inland Surveys

The early maps were based upon exploratory surveys, and, even to-day, large sections of the province are mapped from the same class of information. The early overland expeditions to the Pacific, the maritime surveys, the journeys of the gold seekers, the explorations of the Geological Survey, the delimitation of the international and interprovincial boundaries, and the exploratory surveys for the Canadian Pacific and other railways, as well as the surveys of individual parcels of land, have each yielded their quota to the sum total of knowledge respecting the physical geography of the country. It was not until comparatively recent years that any systematic attempt was made to conduct the survey of the province as part of a co-ordinated whole.

In order to understand the situation in regard to land surveys in British Columbia, it is necessary to remember that since the opening up of the country, two main classes of surveys have been made: First, Government surveys, made by land surveyors under the direct instructions of the Dept. of Lands; second, private surveys, made by land surveyors under the instruction of and paid for by the person who had acquired the statutory right to a piece of unsurveyed Crown land. Government surveys were generally continuous over extensive areas of unalienated Crown lands, but, until quite recently, were carried out rather spasmodically. Private surveys, as a rule, consisted in the laying out of individual parcels held under pre-emption record, application to purchase, timber license, etc., and, frequently, such areas were not tied in or connected to any point the position of which was adequately defined and known. The practical alienation of Crown land before survey is peculiar to this province and is due largely to the broken nature of the country.*

Since 1908, there has been a great increase in the amount of survey work undertaken, and, in connection with the survey of vacant Crown lands, a change has taken place. Formerly, these were privately surveyed under the supervision of the Government, but now the larger proportion are actually surveyed by the Government.† Mr. G. H. Dawson, when Surveyor-General, did much to systematize the surveying operations of the Province and to have the survey data made available in such form as would facilitate its being promptly and satisfactorily mapped.

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* Another fact which complicates the situation in respect to surveys is that different rights may be granted for the same piece of land. Thus, rights may be granted under the Land Act, the Coal and Petroleum Act, and the Mineral Act. Under the Land Act, lands may be pre-empted, purchased, or leased, etc.; also under this Act, special timber licenses were issued giving the right to cut timber on an area not exceeding 640 acres. The boundaries of these relatively small parcels of land, owing to the method of planting 'application posts,' frequently overlapped. In an extreme case, for the same piece of land, rights might be granted to the surface, under the Land Act; to the coal or petroleum, under the Coal and Petroleum Act; to other minerals, under the Mineral Act; and, at the same time, the whole area might be included in a timber leasehold granted prior to 1892. Surveys and plans would be made for each of these rights, and, in practice, the overlapping of two surveys is common, and the overlapping of three is not infrequent.

† In the years 1900 to 1906, less than 2 per cent of such lands were surveyed by the Provincial Government; in 1914, 76 per cent were so surveyed, and in 1915, 87 per cent. At present, with the exception of mineral claims and leases, private surveying of Crown lands is practically at an end.

The system of surveys adopted in the Railway Belt is an extension of the Dominion lands system of surveys as used in the Prairie Provinces.

The report of the Minister of Lands, British Columbia, for 1914, contains a map showing the situation of all surveyed lands in the province. This map does not show surveyed mineral lands, relatively small in extent, nor the large number of isolated areas of only a few hundred acres each that are found widely scattered throughout the province. This map, in conjunction with the explanatory note on pages D54 and 55 of that report, will give a good idea of the present status of surveyed land in the province. Since 1914, owing to the war, survey operations have been reduced to a minimum.

In addition to surveys undertaken or supervised by the Surveys Branch of the Department of Lands, both the Forests Branch and Water Rights Branch of the Department have, since their organization, been making special surveys appertaining to their respective work.*

Besides this work of the Department of Lands, surveys made by the Geological Survey of Canada, and by the various Boundary Commissions, have done much to assist the accurate mapping of the province.

Provincial Government Maps

So far as the mapping activities of the Provincial Government are concerned, they may be considered under two periods, *viz.*, the maps published prior to 1911, and those published since that year. The early maps are of various descriptions, comprising topographical, geographical, land, mining-claim and sketch maps. The greater number of these are now either out of print or out of date. The remarkable development of British Columbia during the last decade created a rapidly increasing demand for maps. To meet this demand efficiently, the Chief Geographer, Mr. G. G. Aitken, inaugurated a comprehensive scheme for the systematic mapping of the province. The compilation of existing data and the issuance of new maps were made to conform to this general co-ordinated scheme and, at the time of the outbreak of the war, excellent progress had been made. The main features comprised in this plan consist of : (*a*) A 'Standard Reference World Map' of British Columbia, conforming with a standard map of the world now being published by various countries, on the scale of $\frac{1}{1000000}$; (*b*) 'Special District Geographic Maps' of the middle and southern portions of the province on a scale of $\frac{1}{500000}$ (7·89 miles to 1 inch). See Maps Nos. 1E and 1G ; (*c*) 'Special District Land Maps,' scale 4 miles to 1 inch, of the areas that contain sufficient land surveys to justify their issuance ; see below under 'Land Series' ; (*d*) 'Degree Sheets' and (*e*) 'Pre-emptor Maps'—these are also referred to more fully below.

The maps now available for distribution by the British Columbia Government are broadly grouped into six or seven classes : Geographical series, Land

* For fuller information consult ***Annual Reports of the Minister of Lands***, British Columbia, particularly those for 1912, 1913 and 1914.

series, Pre-emptor series, Degree sheets, Topographical series, Miscellaneous and Departmental Reference maps. Certain maps of these various series will be found essential in supplying information respecting ownership of lands for rights-of-way, etc.

Geographical Series—This includes the large four-sheet map of the province, on a scale of 17·75 miles to one inch; also a number of smaller single-sheet reproductions, coloured to show the various divisions of the province, on a scale of 30 miles to one inch. This series of maps is usually the most serviceable for determining the watershed areas of the larger drainage basins, and, even where larger scale maps are available for the whole or portions of smaller watersheds, it is well to check any areas obtained from such by making reference to the more comprehensive maps which show the adjoining territory.

Land Series—Shows, in colours, Crown-granted lands, timber leases and licenses, and Indian and government reserves. Scale, 4 miles to one inch. The older maps of this character, such as Nos. 20 and 27, now classified under 'miscellaneous,' were on other scales.

Pre-emptor Series—Primarily intended for use of land seekers, but have been found to be of wider service, and, in recent years, have been much improved. They show land available for pre-emption, reserved for University purposes, and reserved for public auction, also forest and other reserves. These maps are rapid compilations of the provincial land surveys, with the addition of railway and road surveys. New editions, giving the results of the latest surveys and revisions, are frequently published.

Degree Sheets—Scale of 2 miles to one inch. These are so called because each sheet covers an area of one degree in longitude by one degree in latitude. They are carefully compiled to incorporate all survey information to date, and, from time to time, are brought up to date and re-issued.

Topographical Series—Map No. 5A is the first of this new series, scale of 5 miles to one inch. It is contoured and is compiled from exploratory surveys and shows all available information.

Miscellaneous—These include a number of maps which are still of some value. Most of the territory covered by these maps is, however, shown on the more recent maps of the Geographic series.

Departmental Reference Maps—The originals of these maps are drawn on tracing linen; they are compiled from all available data and are constantly being amended. Of late the style of these maps has been much improved, and care is taken to have the information as complete and authentic as possible, but their accuracy is not guaranteed. These reference maps show lands alienated and applied for, timber limits, coal licenses, etc., surveyed and unsurveyed. They were prepared originally for departmental use, but, having been found of value to the public, have been made available in the form of blue-prints, which are on sale at the Legislative buildings, Victoria, at $1.00 or $1.50 each.

MAP LIST No. II

Maps Published by the Department of Lands, British Columbia

Map No.	Year of issue	Title of map	Scale	Approximate size of map
				Inches hor. vert.
		Geographic Series—		
1A	1912	British Columbia. In four sheets. Showing roads and trails, railway systems, etc.	17·75m. to 1 inch	59×52
1B	1913	British Columbia. In one sheet. Showing Land Districts	30m. " "	35×29
1C	1913	British Columbia. In one sheet. Showing Land Recording Divisions	30m. " "	35×29
1D	1913	British Columbia. In one sheet. Showing Mining Divisions (Amended 1917)	30m. " "	35×29
1E^M	1915	Kootenay, Osoyoos, and Similkameen. Showing Mining Divisions	7·89m. " "	37×27
1E^R	1915	Kootenay, Osoyoos, and Similkameen. Showing Land Recording Divisions	7·89m. " "	37×27
1F	1915	British Columbia. In one sheet. Showing Electoral Divisions	30m. " "	35×29
1G	1916	Cariboo and Adjacent Districts. Showing Land Recording Divisions	7·89m. " "	31×43
1H	1917	Northern British Columbia	17·75m. " "	41×26
		Land Series—		
2A	1913	Southerly Vancouver Island	4m. " "	41×27
B	1914	New Westminster and Yale Districts	4m. " "	39×29
*2C	1918	Northerly Vancouver Island	4m. " "	..×..
		Pre-emptor Series—		
3A	1916	Fort George	3m. " "	40×27
3B	1917	Nechako	3m. " "	40×26
3C	1914	Stuart Lake	3m. " "	39×24
3D	1915	Bulkley Valley	3m. " "	43×30
3E	1914	Peace River	4m. " "	26×36
3F	1915	Chilcotin	3m. " "	26×40
3G	1915	Quesnel	3m. " "	26×40
3H	1915	Tête Jaune	3m. " "	40×26
3J	1917	North Thompson	3m. " "	26×40
3K	1915	Lillooet	3m. " "	30×42
3L	1915	Graham Island, Queen Charlotte Islands	3m. " "	22×28
3M	1916	Prince Rupert	3m. " "	30×42
		Degree Series—		
†4A	1912	Rossland Sheet	2m. " "	23×35
†4B	1912	Nelson Sheet	2m. " "	23×35
†4C	1912	Cranbrook Sheet	2m. " "	23×35
4D	1913	Fernie Sheet	2m. " "	23×35
4E	1913	Upper Elk River Sheet	2m. " "	13×23
4F	1913	Duncan River Sheet	2m. " "	23×35
4G	1914	Windermere Sheet	2m. " "	23×35
4H	1915	Arrowhead Sheet	2m. " "	23×35
		Topographical Series—		
5A	1916	Omineca and Finlay River Basins, Sketch map of	5m. " "	26×38
		Miscellaneous—		
48	1913	Sayward District, Sketch map of	3m. " "	..×..
†33	1912	Yale District and Portion of Adjacent Districts	8m. " "	26×39

* In course of compilation.

† Out of print; No. 11 and part of No. 33 are superseded by No. 1E of the Geographic Series.

FRASER RIVER, HELL GATE CAÑON
Showing typical stretch of river with characteristic topography

MAP LIST No. II—Continued

Map No.	Year of issue	Title of map	Scale	Approximate size of map
				Inches hor. vert.
27	1912	Rupert and Coast Districts, Portions of..........	3m. to 1 inch	35×25
22	1912	Northern Interior..........................	17·75m. " "	35×22
†20	1912	New Westminster and Vancouver Island, Portions of..........................	3m. " "	36×26
18	1912	British Columbia, South-west Portion of (Second issue)..........................	12m. " "	31×25
†11	1911	Kootenay District, East and West, showing Mining Divisions..........................	8m. " "	26×31
9	1907	Northern Interior. (A. G. Morice)..............	10m. " "	29×25
7	1903	British Columbia. In two sheets..............	20m. " "	54×45
5	1898	East Kootenay District, Triangulation Survey of...	6,000ft. " "	29×33
4	1897	Osoyoos District, Portion of..................	2·5m. " "	24×29
3	1897	Kootenay District, West Division, and Part of Lillooet, Yale, etc., Mining Recording Divisions.	8m. " "	..×..
2	1896	West Kootenay District, Portion of..............	1m. " "	36×31
1	1895	Vancouver Island, West Coast, Portion of ; Clayoquot District..........................	½m. " "	..×..

NOTE.—*Prices of Maps :* No. 1A is $1.00 ; the remainder of the Geographical, Land, and Topographical series are 25 cents each per copy. The Degree sheets are 10 cents each per copy. The Pre-emptor sheets are free, but a charge of $1.00 per dozen is made for a number of copies of any one sheet. The Miscellaneous maps are 10 or 25 cents each per copy. Applicants should state "Map Number" of sheet desired.

MAP LIST No. III

Maps Published by the Department of Lands, British Columbia (*continued*)

DEPARTMENTAL REFERENCE MAPS

No.	Description of area covered	Scale
1	West Coast, V.I. (Barkley Sound, Southerly)..................	1 mile to 1 inch
1A	West Coast, V.I. (Barkley Sound, Northerly)..................	" "
2	West Coast, V.I. (Nootka District)..................	" "
2A	West Coast, V.I. (Rupert District, S.W. Portion)..................	" "
3	Belize and Seymour Inlets..................	" "
3A	Quatsino Sound and N.W. Portion of Rupert District..................	" "
3B	Gilford, Cracroft, and Broughton Islands..................	" "
3C	Nimpkish River, Valley and Lake..................	" "
3D	Central Portion of Rupert District..................	" "
4	Knight, Bute, and Toba Inlets..................	" "
4A	Sayward District..................	" "
5	Texada Island and West Portion, New Westminster District........	" "
5A	Jervis and Seechelt Inlets..................	" "
5B	Howe Sound and Cheakamus River Valley..................	" "
5C	Harrison Lake and Lillooet River Valley..................	" "
5D	Powell Lake..................	" "
6A	Nicola District..................	" "
6B	Princeton and Vicinity..................	" "
6C	Ashnola and South Similkameen River Valleys..................	" "
7	North Okanagan (Osoyoos District)..................	" "
7A	South Okanagan and Kettle River Valley..................	" "
7B	Similkameen District (Keremeos, Fairview, and Greenwood)........	" "
11	Clearwater and Murtle River Valleys..................	" "
11A	North Thompson River Valley..................	" "
12	Dean and Burke Channels and Rivers Inlet..................	2 miles "
12A	Bellakula Valley..................	1 mile "
14	Banks and Pitt Islands and Vicinity..................	" "
14B	Gardner Canal and Vicinity..................	2 miles "
15	Moresby Island, Northern Portion..................	1 mile "

MAP LIST No. III—Continued

No.	Description of area covered	Scale
15A	Moresby Island, Southern Portion	2 miles to 1 inch
16	Graham Island, North-east Portion	1 mile "
16A	Graham Island, South-east Portion	" "
16B	Graham Island, West Portion	" "
17	Portland Canal and Observatory Inlet	" "
17A	Skeena River Valley (Mosquito Creek to Kispiox River)	" "
17B	Nass and Kitwancool River Valleys	" "
18A	Tête Jaune Cache and Upper Fraser River Valley	" "
19	Lower Skeena and Zymoetz River Valleys	" "
19A	Skeena and Kitsumgallum River Valleys	" "
19B	Prince Rupert, Mouth of Skeena and Nass Rivers	" "
20	Bulkley River Valley (Hazelton to Moricetown)	" "
21A	Fraser Lake and Nechako Valley	" "
21B	François and Ootsa Lakes	" "
21C	Douglas Channel and Kildala Arm	" "
22	Bowron River and Upper Fraser River Valley	" "
22A	Fort George and Vicinity	" "
22B	Portion of Nechako River Valley and Cluculz Lake	" "
22C	Blackwater and Mud River Valleys	" "
22D	Fraser River Valley, Vicinity of Quesnel	" "
22E	Goat River and Upper Fraser River Valleys	" "
23	Quesnel Lake (East Arm)	2 miles "
23A	150-Mile House, Barkerville and Quesnel Lake	1 mile "
4A	Anderson and Seton Lakes, Lillooet District	" "
24B	Lillooet District (Clinton, Big Bar, and Bridge River Valley)	" "
25	Mainland Coast, Hecate Island to Princess Royal Island	" "
26	Porcher and Adjacent Islands	" "
27	Fraser River Valley (Williams Lake, Soda Creek, and Alexandria)	" "
27A	Fraser and Chilcotin River Valleys, Dog Creek	" "
27B	Lac la Hache and Northern Lillooet	" "
28	North Part of Babine and Takla Lakes	2 miles "
28A	Stuart and Babine Lakes	1 mile "
29	Chilcotin, West 124th Meridian	" "
29A	Anahim and Ahuntlet Lakes	" "
29B	Nazko and Chilcotin River Valleys	" "
30	Bonaparte River Valley and Canim Lake	" "
31	Bulkley Valley	" "
31A	François and Babine Lakes	" "
32A	Tatlayoko Lake	" "
32B	Homathko and Klinaklini River Valleys	" "
34	Lot 4593, Kootenay District, West Portion, Flathead River	½ mile "
34A	Lot 4593, Kootenay District, East Portion, Flathead River	" "
35	Saltspring, Gabriola, and Adjacent Islands	1 mile "
35A	Groundhog Coal Area, East of Meridian	" "
38B	Groundhog Coal Area, West of Meridian	" "
38C	Upper Nass River Valley	" "
39	Euchiniko Lake and Upper Blackwater River Valley	" "
40	Tetachuck and Euchu Lak[illegible]	" "
42	Big Bend, Kootenay District	" "
42A	Adams Lake and River	" "
42B	Canoe River Valley	" "
42C	Columbia River Valley (Vicinity of Bush River)	" "
43	Peace River, South of Dominion Government Reserve	" "
45	Foreshore of Vancouver Island (E. & N. Railway Belt)	" "
46	Saanich District and Islands	" "
47	Peace River Valley, West of Dominion Government Reserve	" "
48	Crooked and Parsnip River Valleys	" "
49	Pine River Valley, Peace River District	" "
50	Parsnip and Peace River Valleys	" "
51	Finlay River Valley	" "
52	Atlin Lake and Vicinity	2 miles "
53	Telegraph Creek and Stikine River Valley	" "
54	Upper Nass River Valley and Meziadin Lake	1 mile "

MAP LIST No. III—Continued

No.	Description of area covered	Scale
18-9s	Rossland and South end of Lower Arrow Lake	1 mile to 1 inch
17-9s	Nelson and Salmon River Valley	" "
16-9s	Moyie River Valley	" "
15-9s	Elko, Vicinity	" "
15-9N	Fernie and Crowsnest, Vicinity	" "
16-9N	Cranbrook and Kootenay River Valley	" "
17-9N	Kaslo and Kootenay Lake	" "
18-9N	Edgewood and Lower Arrow Lake	" "
15-0	Elk and White River Valleys	" "
21-23	Duncan Lake and Columbia Lake	" "
18-20	Nakusp and Vicinity	" "
27-29	Columbia River Valley, Wilmer and Spillimacheen	" "
30-32	Trout and Upper Arrow Lakes	" "

Department of the Interior Maps

The Department of the Interior, Canada, has published maps relating to British Columbia, as follows :

MAP LIST No. IV

Maps of British Columbia, published by the Department of the Interior, Canada

Title	Date	Scale
Western Canada (British Columbia, Alberta, Saskatchewan and Manitoba)	1914	35m. to 1 inch
Southern British Columbia (Railway Belt and south to International Boundary), 2 sheets	1914	7·89m. " "
Index to Townships in Manitoba, Saskatchewan, Alberta and British Columbia. Showing the townships for which official and preliminary plans have been issued	1917	35m. " "
Topographical Map of the Rocky and Selkirk mountains between Lat. 50° 37′ and 51° 44′ N., Long. 115° 55′ and 118° 21′ W.	1914	1·97m. " "
Rocky Mountains, Lake Louise sheet. Contoured map	1902	2m. " "
Rocky Mountains, Banff sheet. Contoured map	1902	2m. " "
*Southeastern Alaska and Portion of British Columbia, showing award of Alaska Boundary Tribunal, Oct. 20, 1 03	1903	15·1m. " "
Southern British Columbia—(Homestead Map)—Railway Belt	Jan., 1914	7·89m. " "
Sectional Sheets, Railway Belt, as follows :		
No. 10, Port Moody Sheet	Jan. 8, 1913	3m. " "
No. 11, Yale Sheet	Mar. 26, 1913	3m. " "
No. 61, Lytton Sheet	Apr. 21, 1913	3m. " "
No. 111, Kamloops Sheet	Mar. 1, 1916	3m. " "
No. 112, Sicamous Sheet	June 1, 1915	3m. " "
No. 113, Spillimacheen Sheet	July 1, 1914	3m. " "
No. 162, Seymour Sheet	Apr. 1, 1914	3m. " "
No. 163, Donald Sheet	Sept. 5, 1913	3m. " "

* Out of print.

Geological Survey of Canada Maps

The Geological Survey of Canada, in connection with its geological investigations, has, in addition to many exploratory maps, prepared detailed topographic maps of large areas of the province ; much of this work in recent

years has been carried out by photographic methods controlled by a triangulation network. A list of the chief maps relating to British Columbia, prepared by this Survey, follows :

MAP LIST No. V

Maps of British Columbia published by the Geological Survey of Canada*

Publication number	Title	Date	Scale
87	Coalfields of Nanaimo and Comox, Vancouver Island....	1871	10m. to 1 inch
90	Part of Strait of Georgia and Vancouver Island, showing portion of Comox coalfield..........	1872	2m. " "
111	Sketch Survey of Route from Quesnel Mouth, by Stewart and McLeod's Lakes to Junction of Smoky and Peace Rivers..........	1875	6m. " "
120	Geological Map of Portion of British Columbia between Fraser River and Coast Range..........	1875–76	8m. " "
121	Coalfields of Comox, Nanaimo and Cowichan on Vancouver and Adjacent Islands..........	1876–77	4m. " "
127†	Portion of Southern Interior of British Columbia........	1877	m. " "
139	Map of Queen Charlotte Islands..........	1878	8m. " "
140	Plans of Harbours, Queen Charlotte Islands	1878	2m.‡ " "
141	Geological Map of Skidegate Inlet, Queen Charlotte Islands	1878	1m.‡ " "
149	Map illustrating the Distribution of the More Important Trees in British Columbia..........	1880	50m. " "
	Part of British Columbia and North-West Territory from Pacific Ocean [Mouth of Skeena] to Edmonton	1879–80	8m. " "
150	Sheet I—Fort Simpson to Fort St. James		
151	Sheet II—Fort St. James to Dunvegan		
223	Reconnaissance Map of the Rocky Mountains between latitudes 49° N. and 51° 30′ N..........	1886	6m. " "
247	Northern Part of Vancouver Island and Adjacent Coasts.	1887	8m. " "
274	Index Map of Yukon District, N.W.T.; Northern Portion of British Columbia and Adjacent Regions..........	1888	60m. " "
	Yukon Territory and British Columbia..........	1888	8m. " "
275	Sheet I—Stikine and Dease Rivers..........		
276	Sheet II—Upper Liard and Frances Rivers and upper Pelly River..........		
277	Sheet III—Lower portion of Pelly and Lewes Rivers..		
278‖	Cariboo Mining District..........	....	2m. " "
303	Reconnaissance Map of a Portion of West Kootenay District..........	1890	8m. " "
304	Index Map showing Routes followed by the Yukon Expedition, 1887-88..........	1891	48m. " "
	Mackenzie, Liard, Porcupine and Yukon Rivers, nine sheets (Sheet 4 includes portion of British Columbia)		
308	Sheet 4—Liard River..........	1890	8m. " "
363	Portion of the Southern Interior of British Columbia, 1887	1888	8m. " "
556	Kamloops Sheet, Geologically coloured..........	1895	4m. " "
557	Kamloops Sheet, Topography, Economic Minerals, etc.	1895	4m. " "
567	Finlay and Omineca Rivers..........	1895	8m. " "
604	Shuswap Sheet, Geological..........	1898	4m. " "
669	Shuswap Sheet, Economic Minerals, Glacial Striæ, etc....	1898	4m. " "
676	Yellowhead Pass Route from Edmonton to Tête-Jaune Cache..........	1900	8m. " "

*For List of Reports and Memoirs dealing with various areas shown on the maps, consult *Bibliography*. The maps in List No. 5 most serviceable for topography of extensive watershed areas are the 'sheet' maps, such as 'Kamloops Sheet' (557), 'Nanaimo Sheet' (1570), etc.

† See also Publication No. 363.

‡ Scale in 'geographic' miles.

‖ For maps showing quartz veins and placer mines of a number of creeks in the Cariboo Mining District, see maps, Publication Nos. 279, 280, 281, also 364 to 372, inclusive.

MAP LIST No. V—Continued

Publi-cation number	Title	Date	Scale
711	Map of Atlin Gold Fields	1901	6m. to 1 inch.
742	Geographical Map of Atlin Mining District	1902	4m. " "
754	Index Map of Southern British Columbia	1901	50m. " "
767	Geographical and Topographical Map of Crowsnest Coal fields, East Kootenay, B.C.	1902	2m. " "
791	West Kootenay District, Economic Minerals, etc.	1902	4m. " "
792	West Kootenay District, Geological	1904	4m. " "
828	Geological and Topographical Map of Boundary Creek Mining District	1905	1m. " "
834	Topographical Edition of Map 828	1905	1m. " "
853	Index Map, West Kootenay District	1904	8m. " "
890	Coal Basins of Quilchena Creek, Coldwater River, Coal Gully and Guichon Creek	1904	1m. " "
921	Graham Island Coal Field	1906	4m. " "
922	Geological Map of Graham Island	1906	4m. " "
941	Preliminary Geological Map of Rossland and vicinity	1906	1,600ft. " "
987	Geological and Topographical Map of Princeton and Copper Mountain Mining Camp, Yale District	1906	40ch. " "
989	Sketch Geological Map of Telkwa River and Vicinity, Omineca Mining District	1906	2m. " "
997	Geological Map of part of Nanaimo and New Westminster Mining Division	1906	4m. " "
1001	Special Map of Rossland, Topographical	1908	400ft. " "
1002	Special Map of Rossland, Geological	1909	400ft. " "
1003	Rossland Mining Camp, Topographical	1909	1,200ft. " "
1004	Rossland Mining Camp, Geological	1909	1,200ft. " "
1068	Sketch Map, Sheep Creek Mining Camp, Geological Edition	1909	1m. " "
1074	Sketch Map, [illegible] Creek Mining Camp, Topographical Edition	....	1m. " "
1095	1A—Hedley Mining District, Topographical	1910	1,000ft. " "
1096	2A—Hedley Mining District, Geological	1910	1,000ft. " "
1105	4A—Golden Zone Mining Camp, near Hedley	1910	600ft. " "
1106	3A—Mineral Claims on Henry Creek near Hedley	1910	800ft. " "
1123	17A—Southern Vancouver Island	1911	6m. " "
1135	15A—Phoenix, Topographical	1911	400ft. " "
1136	16A—Phoenix, Geological	1911	400ft. " "
1147	19A—Lardeau, West Kootenay, Topographical Map	1911	4m. " "
1148	20A—Victoria Sheet, Vancouver Island, Topographical	1911	1m. " "
1149	21A—Saanich Sheet, Vancouver Island, Topographical	1911	1m. " "
1164	28A—Geological Sketch Map of Portland Canal Mining District	1911	2m. " "
1167	29A—Mother Lode and Sunset Mines, Topography	1911	400ft. " "
1168	30A—Mother Lode and Sunset Mines, Geology	1911	400ft. " "
1179	33A—Nanaimo Sheet, Topography	1915	1m. " "
1182	36A—Beaverdell, Yale District, Topography	....	1m. " "
1183	37A—Beaverdell, Yale District, Geology	1915	1m. " "
1191	41A—Duncan Sheet, Vancouver Island, Topography	1917	2m. " "
1193	43A—Sooke Sheet, Vancouver Island, Topography	1914	2m. " "
1195	45A—Tulameen, Topographical Map	1911	1m. " "
1196	46A—Tulameen, Geological Map	1911	1m. " "
1197	47A—Law's Mining Camp, Tulameen	1911	600ft. " "
1198	48A—Tulameen Coal Area, Yale district	1911	½m. " "
1200	50A—Portland Canal Mining Area, Topography	1911	2m. " "
1201	51A—Geological Map of portion of Alberta, Saskatchewan and Manitoba*	1911	35m. " "
1219	54A—Nanaimo Coal Area, Vancouver Island, Economic Geology	1912	1½m. " "
1221	55A—Geological Map of Alberta, Saskatchewan, and Manitoba*	1914	35m. " "

* Also portion of British Columbia.

MAP LIST No. V—Continued

Publication number	Title	Date	Scale
1222	56A—Skagit Valley, Yale District, Areal geology	....	0·986m. to 1 inch
1237	62A—Nelson and Vicinity, Kootenay District, Geology	1912	1m. " "
1241	65A—Coast and Islands, Areal Geology	1913	4m. " "
1251	70A—Victoria Sheet, Vancouver Island, Geology	1914	1m. " "
1252	71A—Victoria Sheet, Vancouver Island, Superficial Geology	1915	1m. " "
1253	72A—Saanich Sheet, Vancouver Island, Geology	1914	1m. " "
1254	73A—Saanich Sheet, Vancouver Island, Superficial Geology	1915	1m. " "
1260–1276	74A to 90A—Geology of the 49th Parallel, 17 sheets	....	0·986m. " " 1m. " "
1278	92A—Coast and Islands between Queen Charlotte Sound and Burke Channel, Geology	1913	4m. " "
1283	94A—Taku Arm, Atlin district	1913	4m. " "
1287	105A—Cadwallader Creek Mining Area, Lillooet District, Geology, outline edition	1913	2,000ft. " "
1296	Graham Island, Queen Charlotte Group, Geology, diagram	....	16m. " "
1298	99A—Southern Portion of Cranbrook map-area, East and West Kootenay, Geology	1913	4m. " "
1303	104A—Thompson River Valley, Geology, outline edition	1913	4m. " "
1304	106A—Groundhog Coal Field	1913	4m. " "
1313	109A—Prescott, Paxton and Lake Mines, Texada Island, Topography	1915	400ft. " "
1314	110A—Prescott, Paxton and Lake Mines, Texada Island, Geology	1915	400ft. " "
1319	111A—Vananda, Texada Island, Topography	1915	2,000ft. " "
1320	112A—Vananda, Texada Island, Geology	1915	2,000ft. " "
1321	Diagram showing the Geology of Texada Island	1912	2m. " "
1351	120A—Quadra Island	1914	4m. " "
1372	125A—Coal Areas of Canada	1914	240m. " "
1376	129A—Coal Areas of Alberta and British Columbia	1914	40m. " "
1378	131A—Southern Vancouver Island Coal Area	1914	6m. " "
1392	136A—Hazelton-Aldermere, Cassiar and Coast Districts, Topography	1914	4m. " "
1412	139A—Coal Fields of British Columbia	1915	35m. " "
1445	142A—Field, Kootenay District	1915	2m. " "
1446	143A—Shuswap Lake, Kamloops District	1915	4m. " "
1528	147A—Cranbrook, Kootenay District	1915	4m. " "
1567	157A—East Sooke, Vancouver Island, Topography	1917	2,000ft. " "
1568	158A—Nanaimo Sheet, Vancouver Island, Geology	1916	1m. " "
1569	159A—Nanaimo Sheet, Vancouver Island, Surface Geology	1916	1m. " "
1570	160A—Nanaimo Sheet, Vancouver Island, Topography	1916	1m. " "
1583	166A—Portion of Flathead Coal Area, Topography	1917	1m. " "
1594	175A—Ymir, Kootenay district	1916	1m. " "
1597	176A—Graham Island	1916	4m. " "
1598	177A—Southern Portion of Graham Island	1916	2m. " "
1610	Diagram of Bridge River Area, Lillooet Mining Division	1915	3m. " "
1629	182A—Portion of Flathead Coal Area, Geology	1917	1m. " "
1654	167A—East Sooke, Vancouver Island, Geology	1917	2,000ft. " "
1667	Slocan Mining Area, Geology	1916	1m. " "

Maps of the International Boundary Commission

Under the Convention between Great Britain and the United States, signed at Washington, 21st April, 1906, the international boundary between the United States and Canada along the 141st meridian has been surveyed from the Arctic ocean to mount St. Elias. The results of this survey are pre-

sented on 38 maps, prepared and adopted by the Commissioners * under Article II of the Convention just referred to. These maps show in detail the topography of strips 2 to 5 miles wide on each side of the boundary.

The maps of the Boundary Survey southward from mount St. Elias are in process of publication.

The survey for the re-establishment of the international boundary from the strait of Georgia to the northwesternmost point of the lake of the Woods, under Articles VI and VII of the Treaty between Great Britain and the United States, signed at Washington, 11th April, 1908, has been completed. The maps consist of a series of 59 charts, of which sheets 1 to 19 inclusive extend from the strait of Georgia to the summit of the Rocky mountains. They include the topography of strips two miles wide on each side of the boundary and the various water courses are shown in detail. Sets of these maps are available for reference at provincial and other prominent libraries.

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* Commissioners for the International Boundary Commission—for His Britannic Majesty, W. F. King, 1905-1916 ; J. J. McArthur, 1917 ; and for the United States, O. H. Tittman, 1906-1915 ; E. C. Barnard, 1915.

CHAPTER IX

General Topography of British Columbia

TO convey a satisfactory knowledge of the water-power possibilities of British Columbia, it is necessary to set forth the general topography of the province and the situation and character of the mountain ranges which so largely influence the climate and the distribution of precipitation. To this end the prominent natural features of the province are outlined, followed by a more detailed description of various individual watersheds. The accompanying Physiographic map will be of assistance in connection with the descriptions.

British Columbia has an area of about 355,855* square miles. It includes a length of over 800 miles of the North American cordillera, a mountainous region between the Great plains and the Pacific ocean, which, in this part of its length, has an average breadth of about 400 miles. The cordillera here includes a series of great mountain systems all lying practically parallel with the coast : † (1) the Rocky mountains ; (2) the Columbia system, which includes (a) Selkirk mountains (b) Monashee mountains and (c) Cariboo mountains ; (3) Interior system, which includes (a) Fraser plateau, (b) Nechako plateau, (c) un-named mountains and plateaus ; (4) Cassiar system, which includes (a) Babine mountains, (b) Stikine mountains, (c) un-named mountains; (5) Yukon system, which includes (a) Yukon plateaus, (b) un-named mountains and plateaus ; (6) Pacific system, which includes (a) Cascade mountains, (b) Coast mountains, (c) Bulkley mountains, (d) un-named mountains ; (7) Insular system, which includes (a) Vancouver Island mountains, (b) Queen Charlotte mountains, (c) St. Elias mountains.

Rocky Mountains

The Rocky mountains, the most easterly portion of the cordillera, are about sixty miles wide in the southerly portion, the breadth decreasing to forty miles or less in the Peace River district. South of lat. 53°-30′ N. many of the summits have an altitude exceeding 10,000 feet. There are extensive snowfields, and, in the vicinity of the headwaters of the Bow, North Saskatchewan and Athabaska rivers, where

*According to statistics of areas presented in the *Atlas of Canada*, 1915, the land area of British Columbia is 353,416 sq. miles ; water area 2,439 sq. miles. It is to be noted that this figure for water area includes only the larger lakes. Recent measurements indicate that the total area of the province is upwards of 360,000 square miles, and that the water area is about 4,000 sq. miles. Pending a more detailed computation, it has been deemed advisable to adhere to the older figures. In any event, it should also be borne in mind that, particularly in the northern portion of the province, the surveys of many lakes and other topographic features are not of a high degree of accuracy.

†For a discussion of the nomenclature of the mountain ranges of British Columbia, see *Geology of the North American Cordillera at the 49th Parallel*, by R. A. Daly, being Memoir No. 38, Geological Survey of Canada, Chap. 3, also recent decisions of the Geographic Board of Canada, giving revised classification. For altitudes in British Columbia, consult *Altitudes in the Dominion of Canada* (Second edition), by James White, Commission of Conservation, 1915, also *Dictionary of Altitudes in the Dominion of Canada* (Second edition), by James White, 1916.

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PRINCE GEORGE CAÑON, UPPER FRASER RIVER

COTTONWOOD CAÑON, UPPER FRASER RIVER

TYPICAL VIEW OF COLUMBIA RIVER, NEAR INTERNATIONAL BOUNDARY, TRAIL B.C.

the range appears to culminate, true glaciers are found. Near the Peace river there are few points where the mountains exceed an elevation of 7,000 feet.

On the eastern slopes of the Rockies the valleys are, as a rule, comparatively lightly timbered. Wherever there is sufficient soil the mountains are wooded, and, on the western slope, owing to the greater precipitation, the forests are often dense.

The northeastern portion of British Columbia—between the Rockies and the eastern boundary—resembles western Alberta, and is probably the most extensive area of comparatively level land in the province.

Intermontane Valley

On the southwest the Rocky mountains are bounded by the great Intermontane valley, which can be traced from the 49th parallel in a northwesterly direction for 500 miles. Throughout much of its length it is straight, from two to fifteen miles in width, and is bordered by high mountains (see Plate 8). Whatever its past history, it has now no single main drainage system, but is drained by a number of rivers belonging to distinct systems. Beginning at the boundary, it is drained by the Kootenay, Columbia and Canoe rivers of the Columbia system, and the upper portion of the Fraser river of the Fraser system.

To approximate lat. 54°, the Intermontane valley is easily identifiable, but, near the 'Great bend' of the Fraser, the mountains west of that river die away, and it is not improbable that it echelons to the eastward by the valleys of the Clearwater and McGregor rivers, thence northward by the Parsnip, Finlay, etc. On the other hand, there is strong evidence that, as a great distinctive feature, it really ends near the confluence of the McGregor and Fraser in lat. 54°-10′. If this be correct, the McGregor-Bad-Parsnip valley represents the Intermontane north of this break in its continuity and is traceable along the Finlay and Kachika rivers for over 450 miles. Beyond the Kachika it probably follows the valley of the Frances river for 150 miles, giving this extraordinary feature a total length of over 1,100 miles—assuming that we ignore the conjectural break on the Fraser.

Columbia Mountain System

West of the Intermontane valley lies the Columbia, the second great mountain system. It comprises a complex and irregular mountainous belt, and is composed of several distinct and partly overlapping ranges, the Selkirk and Monashee mountains constituting the southern portion, while to the north are the Cariboo mountains. Generally speaking, these mountains are less rugged than the Rockies. They include wide areas of high rolling plateau, and contain, in their southern and more massive portion, numerous glaciers and extensive snowfields. Their highest known summit is mount Sir Sandford, 11,590 feet, situated about 24 miles north of the Canadian Pacific railway.

As the forests of the ranges of the Columbia system, especially on their western slopes, are heavy and, with their tangled undergrowth, are difficult to traverse, they have been less explored than the corresponding portions of the Rockies.

This second great system of mountains constitutes one of the most important metalliferous belts in the province. Rich placer goldfields are

closely related to it and discoveries of highly argentiferous galenas and other silver ores, as well as auriferous quartz veins, have been made in various localities.

Interior System

Between the Columbia system and the Coast mountains lies the Interior system. In the more southern portion its mean elevation is about 3,500 feet, decreasing to about 2,500 feet in the 'lake' region between 53° and 55°-30'. Its width, between the margins of the Columbia system and the Coast mountains, is about 100 miles in its southern portion, widening towards the north. Its length is about 500 miles. The plateau extends northward to about lat. 55°-30', where it terminates in a plexus of mountains without wide intervals.* It is correct to designate it as a plateau only when viewed in the large and by comparison with the more lofty, bordering mountains. Its surface is diversified by several minor ranges and groups of mountains.

A considerable portion of the plateau has been covered by flows of basalt and other volcanic rocks. It is now traversed in various directions by a system of deeply cut and trough-like valleys. (See Plate 22, showing Chilcotin valley.) The general slope of the plateau is toward the north, and its drainage flows southward, the trough-like valleys increase in depth and size toward the south, and the slopes bounding the plateau areas, when viewed from the larger valleys, have the appearance of mountain ranges.

Probably the best grazing district in British Columbia lies in the open country of the southern portion of the plateau, which also affords, at the lower elevations, good agricultural opportunities. To the north the country becomes more wooded but still has large areas suitable for farming.

Coast Mountains

The Cascade range of Oregon and Washington, largely composed of volcanic material, terminates in the vicinity of the international boundary. North of the Fraser river another mountain system, the Coast mountains, rises and continues in somewhat the same northerly course as the Cascade range—in a sense replacing it. The Coast mountains are largely composed of granite, and form part of the third division of the cordillera in British Columbia. For 900 miles—to the head of Lynn canal, where they pass inland—they constitute the most westerly mainland mountain zone of the continent.

The Coast mountains have an average width of about 100 miles, and are composed of numerous constituent ranges having individual trends and separated by deep valleys. While some of the peaks exceed 9,000 feet, the average altitude of the higher summits is between 6,000 and 7,000 feet. Glaciers are of frequent occurrence and, toward the north, are of large size. These mountains are very rugged and densely forested. (See Plates 9 and 29.) The flora of the seaward slopes reflects the influence of the great humidity of the west coast, while that of the easterly slopes is similar to the flora of the interior.

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* This system of mountains, extending across the province from the Coast mountains to the Intermontane valley, is known as the Cassiar system. It includes the Stikine and Babine mountains and various smaller ranges and groups. It separates the Interior system from the Yukon system.

Vancouver Mountains

The Vancouver mountains, the western subdivision of the Coastal system, traverse the western islands. They include partially submerged ranges which form the backbone of Vancouver island, and reappear in the Queen Charlotte, Prince of Wales and other Alaskan islands. Southward, they are represented by the Olympian mountains in Washington state. In Vancouver island the highest peak, Victoria, rises to 7,484 feet, and a considerable portion of the central area exceeds 2,000 feet in average altitude. In Queen Charlotte islands several summits have an elevation of over 4,000 feet.

Climatic Conditions

With topography so diverse and so accentuated, British Columbia necessarily exhibits corresponding climatic contrasts. Broadly speaking, it may be divided climatically into two main territorial divisions : (1) The maritime climate of the Pacific littoral lying west of the Coast mountains, and including Vancouver, Queen Charlotte and other islands ; (2) the continental climate, modified, however, by the presence of the other mountain systems, of the area lying east of the Coast mountains.

The Kuro Siwo (Black stream), commonly known as the Japan current, sweeps easterly across the northern Pacific, and warms the surface waters of that ocean in a manner corresponding somewhat to the effect of the Gulf stream on the waters of the Atlantic.

Chinook Winds

The moisture-laden westerly winds from these warm waters are deprived of much of their moisture in passing successively over the mountain systems of the province, the moisture being deposited as heavy precipitation on their western slopes. The winds are mechanically heated as they descend the eastern slopes and are thus rendered more susceptible of absorbing moisture and incapable of giving rain. This Chinook or Foehn effect is very marked in the 'dry belt' of the Interior system. This belt, with modifications later described, extends from Washington state to Yukon territory. (See Plate 10.) In the Intermontane valley a second but much narrower dry belt is also found. East of the Rocky mountains this effect is repeated in the irrigation district of western Alberta.

The gradual depletion of the vapour content of these westerly winds results in a decreasing precipitation on the successive ranges. Thus, in the Coastal belt the average annual precipitation ranges from 40 to 200 inches ; on the western slopes of the Columbia system it varies between 30 and 100 ; while on the western slope of the Rocky mountains it is between 20 and 70 inches. In the "dry belt" the average annual precipitation ranges from less than 5 inches to about 20 inches, the least precipitation occurring in the western portion. In the bottom lands of the Intermontane valley it probably averages about 15 to 20 inches.

While it is possible thus to indicate the general trend of precipitation conditions over broad belts of the province, the comparatively meagre records available do not permit satisfactory deductions as to the run-off from the smaller watersheds of the more mountainous regions ; neither is it possible to produce a satisfactory isohyetal chart.

Variations in Precipitation

It will be appreciated that the characteristic meteorological phenomena of these belts are subject to local modification due to the varied elevations of the mountains, such, for example, as result from the lower altitude of the Rocky mountains near the Peace river, and due also to the presence of gaps in the systems, such as the strait of Juan de Fuca, or the break in the continuity of the ranges west of the Parsnip river. The presence of passes, like the Fraser River cañon and the Skeena valley, also cause local variations, and each mountain group or range to some extent becomes a centre of precipitation. These physical influences in places separated by but a few miles, produce striking local differences. Thus, the average annual precipitation at Ladner and Garry Point, near the mouth of the Fraser, is about 37 inches ; at Vancouver, 12 miles north, it is about 60 inches, while at Coquitlam lake, elevation 445 feet, 16 miles northeast of Vancouver, it averages nearly 150 inches. The Vancouver range affects the climate of Vancouver island and the immediate shores of the strait of Georgia in similar fashion—the west coast of the island being wetter than the east coast. The plexus of mountains forming the Cassiar system which bounds the Interior plateau on the north and extends across the province about lat. 55°-30′N. probably causes a more uniform distribution of precipitation over the territory in its vicinity.

It is obvious that these great variations in precipitation contribute to the difficulty of determining the probable run-off from the various watersheds in British Columbia.

For the purpose of this report, the province is conventionally divided into the following five main divisions. Brief descriptive notes of the outstanding topographical features of each division are given ; also a tabulation of possible power sites.

I. Columbia river and its tributaries
II. Fraser river and its tributaries
III. Vancouver Island
IV. Mainland Pacific Coast, north of the Fraser (includes the Skeena, Nass and Stikine, which drain portions of the interior)
V. Tributaries of the Mackenzie river.

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Accompanying report on "Water-powers in British Columbia"
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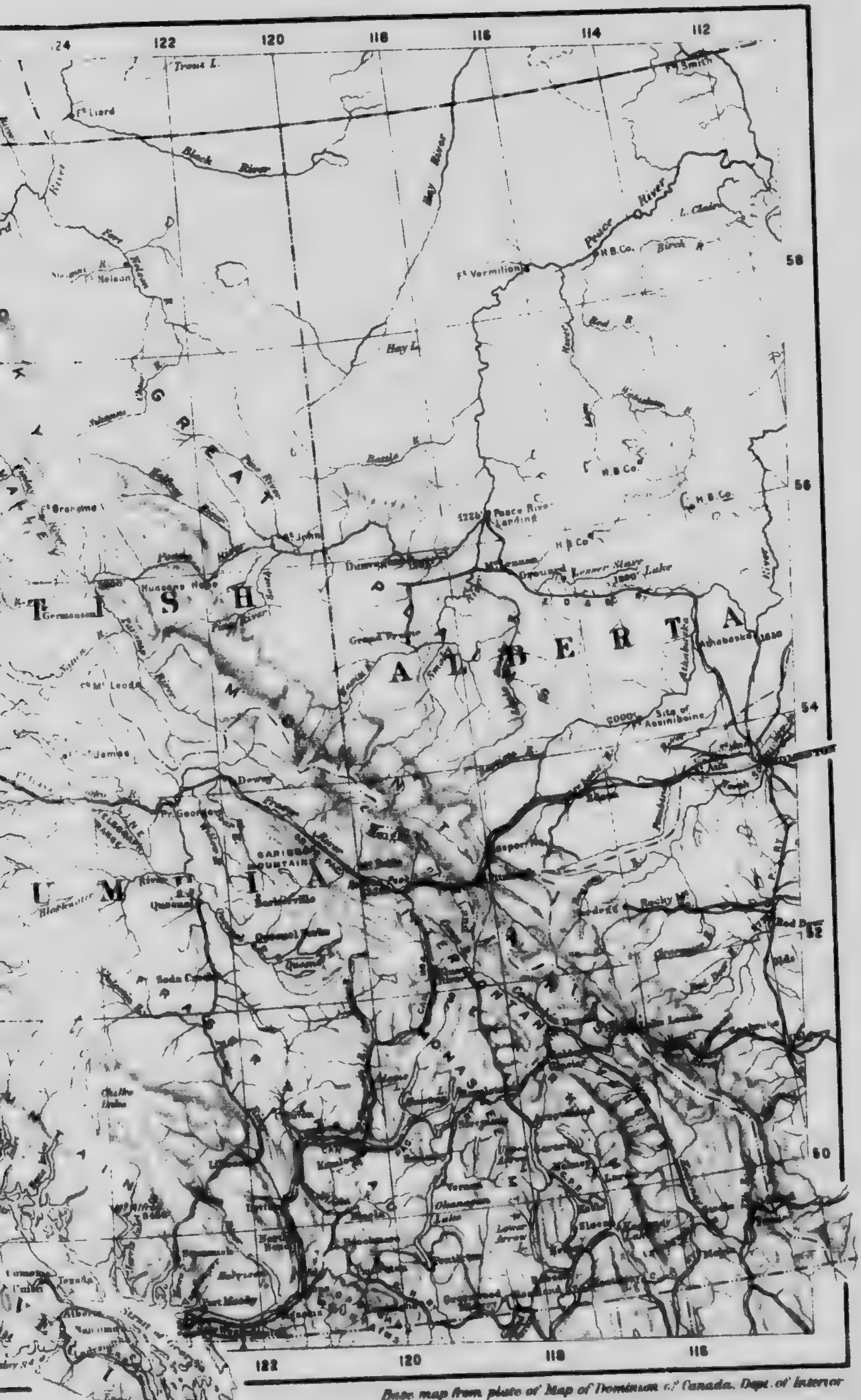

Base map from plate of Map of Dominion of Canada, Dept. of Interior

CHAPTER X

Columbia River and Tributaries—Topography and Power Site Tables

THE Columbia river, one of the larger streams of North America, rises in Columbia lake, in East Kootenay district, B.C. It flows northwesterly through the Intermontane valley to the fifty-second parallel ; thence, it makes what is known as the 'Big bend,' thence, it flows southward, passes through the Arrow lakes and enters the state of Washington just below the confluence of the Pend-d'Oreille river. After traversing Washington in a southerly direction it turns westward and discharges into the Pacific at the forty-sixth parallel. Its total length is about 1,150 miles, of which about 465 miles are in British Columbia.

The total drainage area of the Columbia, as estimated from the best available maps, is 259,000 square miles, broadly apportioned as follows : *

APPROXIMATE AREAS OF THE COLUMBIA RIVER BASIN

Province or state	Area, sq. miles	Percentage of total area
British Columbia	38,700	15·0
Oregon	55,370	21.4
Washington	48,000	18.5
Idaho	81,380	31.4
Montana	25,000	9.7
Nevada	5,280	2.0
Wyoming	5,270	2.0
In United States	220,300	85·0
In British Columbia	38,700	15.0
Total	259,000	100·0

The chief tributaries of the Columbia and the area of their respective watersheds are as follows :

CHIEF TRIBUTARIES OF COLUMBIA RIVER

Approximate distance of confluence from mouth, in miles	Name of stream	Watershed area, square miles		
		Total	In United States	In British Columbia
57	Cowlitz river	2,460	2,460	
90	Willamette river	11,150	11,150	
185	Deschutes river	9,180	9,180	
200	John Day river	7,800	7,800	
300	Snake river	108,600	108,600	
311	Yakima river	5,270	5,270	
500	Okanagan river	8,350	2,350	6,000
600	Spokane river	5,880	5,880	
660	Kettle river	4,260	1,100	3,160
700	Pend-d'Oreille river (Clark fork)	25,820	24,630	1,190
725	Kootenay river	19,450	4,900	14,550

* See *Water Supply Papers*, No. 292, p. 55, and No. 370, p. 13, U.S. Geological Survey, Washington, D.C.

The Columbia River drainage basin has great diversity of topography and climate. The variations are similar to those found generally in British Columbia, although, owing to its more southerly latitude, the mean annual temperature for places of similar elevation is somewhat higher.

In general, the topographic and climatic characteristics of British Columbia continue south of the international boundary, following the trend of the principal mountain ranges. Some of the outstanding topographic features have a counterpart in the adjoining portion of the United States. Thus, in Washington and Oregon the Coast range may be regarded as a counterpart of the Vancouver mountains, and the Cascade range the counterpart of the Coast mountains in British Columbia. These similarities of topography are reflected in the climatic conditions ; thus, between the Coast and Cascade ranges of Washington is a region of lesser precipitation, similar to that found in British Columbia in the vicinity of the strait of Georgia between the Vancouver and Coast mountains. East of the Cascade range of Washington and Oregon the central basin of the Columbia river constitutes a continuation of the dry belt found east of the Coast mountains of British Columbia.

With regard to agriculture, the character of the country ranges from the extremely arid region, where irrigation is essential for the growing of crops, through the semi-arid country, where dry-farming and irrigation are practised side by side, to the well-watered country of the Coast district, though, as more than eighty per cent of the annual precipitation falls between October 15th and May 15th, the last named may be considered semi-arid in the summer months. Although in the Coast district precipitation is usually sufficient for agricultural purposes, yet the fullest development will not be realized in some of the valleys until irrigation is widely practised.

From the Pacific coast of the United States eastward to the summit of the Coast range the precipitation varies from 100 to 150 inches. In the basin between the Coast and Cascade ranges it drops to about 40 inches, increasing again to about 100 at the summit of the Cascades. Eastward of the summit of the Cascades it decreases very rapidly, until, at the foot of the ranges, it is but 14 inches. At the mouth of Snake river the precipitation is about 9 inches per annum, but such very low precipitation obtains only at the lower altitudes. The average precipitation in the valleys of Idaho is about 20 inches, with from 40 to 60 inches on the mountains of the eastern ranges.

Lumbering has been and will long continue to be one of the chief industries of the Columbia River valley.* It has been stated that at least forty-five per cent, or 116,000 square miles, of the drainage area of the Columbia is forested, and, of this amount, probably about one-half is covered with merchantable timber. Although much of the territory has been settled for upwards of sixty-five years, and large areas cleared, yet the ratio of forested area to the total area has not been very materially reduced.

The Columbia river and its tributaries contain about one-third of the available water-powers of the entire United States. It is worthy of note also

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* See *Water Supply Papers* Nos. 292 and 370, U.S. Geological Survey, Washington, D.C.

that some of the largest water-power possibilities in British Columbia are on the Columbia River watershed. Of those on the 'Big bend' of the Columbia, and on its tributaries, the Pend-d'Oreille and Kootenay rivers, the last mentioned only has been partially developed.

Of the area drained by the Columbia, some 38,700 square miles, or 15 per cent, is included in British Columbia. In considering the Canadian portion of the watershed it is convenient to regard it as divided into three main areas —the upper Columbia, the 'Big Bend' district, and that from Revelstoke to the boundary.

Upper Columbia River

The upper Columbia river and its tributaries drain a portion of the Intermontane valley. It rises in Columbia lake, and it is interesting to note that at Canalflat, its headwaters are less than a mile from the Kootenay river.

From Windermere lake to Golden it meanders through the valley in a tortuous channel with many side channels, but is navigable by shallow-draught steamboats. During the latter part of the open season sandbars and shallow places render navigation difficult. It has an average gradient of about one foot per mile. During early summer, when the glaciers and snowfields are rapidly melting, the tributaries are raging torrents, and the main stream floods much bottom land along the valley. It has been proposed to reclaim these overflowed lands by straightening, dredging and dyking the river, and, in addition, by controlling flood waters on the tributaries.

The main valley lies at a general elevation of about 2,600 feet, and ranges in width from eight to twelve miles. As a rule, the ground rises rapidly from the bottom lands near the river to a height of 200 or 300 feet, and then extends back to the mountains in a series of gently sloping benches, broken by ridges or knolls, or by stream gulches, and constituting, if irrigated, good agricultural land. The maximum elevation of agricultural land is about 3,400 feet. Owing to its situation between the Selkirk range and the Rockies, precipitation is deficient, and irrigation is necessary to secure adequate agricultural returns. Several large tracts of land are being developed by irrigation companies.

The valley is fairly well timbered, Douglas fir predominating, especially on the lower benches. Nearer the mountains, jackpine, spruce and tamarac are found, with cottonwood and willows on the wetter soils. There are also stretches of sage-bush, chiefly on the upper benches of the eastern side. Natural grasses grow somewhat sparsely on the lower benches, owing to the dry soil. Good range feed is found on the higher lands. The winter climate is tempered by Chinook winds and extreme cold dips are rare and of short duration.

The Brisco range forms the watershed between the upper Columbia and the Kootenay. The streams which rise on this range have small watersheds, and, with one or two exceptions, do not afford sufficient water with which to irrigate the land available for agricultural purposes. West of the upper Columbia there are several important streams whose valleys deeply penetrate the long eastern slopes of the Purcell and Selkirk ranges. The beds of these streams are, however, eroded to depths far below the surrounding agricultural lands

and, to utilize their waters for irrigation, recourse must be had either to long and expensive ditches, flumes, etc., or to some form of pumping. (See Plate 11.) The streams on the western side have many power possibilities. For comments respecting these consult the tables.

The 'Big Bend' District The name 'Big Bend' district applies to the Columbia River basin north of the Railway Belt. Like several other districts of British Columbia, it first came into prominence upon the discovery of gold on its tributaries. The great 'rush' to this district occurred in 1865.

Following the river, the distance from Golden to Revelstoke is about 185 miles. The length of the Canadian Pacific railway between the same points is 95 miles. (See Plate 16 for view of Illecillewaet valley.) From Golden the Columbia flows northwesterly, in the great Intermontane valley, for 95 miles, to Canoe river. At the mouth of Canoe river it swings to the west and then southward around the end of the Selkirk range.

The valley of the 'Big Bend' is, in general, narrow and lies between mountain slopes. As there are many glacier-fed tributaries, which carry large quantities of silt, the river is generally turbid, and, in warm weather, is liable to sudden floods. The range between high and low stages on the Columbia river gradually increases going downstream. It is said to average about eight feet throughout the upper reaches and increases to about sixteen feet at Revelstoke. The river has frozen over as early as the first week in November, and the ice in Kinbasket lake, 69 miles from Golden, may remain as late as the end of April. Over a narrow belt in the upper portion of the valley the precipitation is small. The western flanks of both the Rockies and Selkirks, however, enjoy a much higher precipitation, which is reflected in a heavy forest cover with dense undergrowth ; this is especially noticeable on the Selkirk range.

Until superseded by the Cape Horn and Panama routes, the canoe-route of the North West and Hudson's Bay companies followed the Columbia from the mouth to Wood river, a few miles from the confluence of the Canoe; thence, the voyageurs packed the furs and goods up Wood river to the Athabasca pass. Their old camp ground at the mouth of Wood river—'Boat Encampment'—is still recognizable. During part of the summer a steamer runs from Revelstoke to Boyd's ranch, a distance of some 30 miles. (See Plate 11 for view of Columbia river above Revelstoke.) Travel by boat round the 'Bend' is both difficult and hazardous, and fatalities in the numerous rapids have been of frequent occurrence.

The total fall in the Columbia from Donald to Revelstoke is about 1,090 feet. In the power lists the principal rapids are tabulated. Eventually the river may yield a large amount of power, but developments will probably be expensive and will not be undertaken until the more easily developed sources of power on some of the tributary streams have been exploited. At certain stages it is navigable from Revelstoke to Canoe river, and any dams built in the river should safeguard navigation.

Canoe river is a rapid stream and, below Goat creek, is navigable only by expert canoemen. It is reported that there are no good power sites, although

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Helmcken fall, near mouth. Sheer fall of 450 feet.

FALLS ON MURTLE RIVER; TRIBUTARY OF CLEARWATER RIVER

UNDEVELOPED POWER ON SHUSWAP RIVER

Site of proposed dam for Coteau Power Co. Looking upstream from old bridge, at peak of flood, June 10, 1913.

the river has not been adequately examined. There are numerous tributaries, mostly glacial streams, which might be developed to supply power for local requirements.

The "Big Bend" district has not been examined in detail from a water-power situation standpoint, but a large number of the tributary streams are known to have power possibilities. The meagre information available is summarized in the tables.

Revelstoke to Boundary

The Columbia from Revelstoke to the boundary occupies a long, deep valley. From Revelstoke to the Upper Arrow lake is about 30 miles by the river. The fall in this portion of the river, at low water, is about 40 feet, and it is navigable by boats drawing three feet. The lower nine miles is relatively slack, the upper portion being rather more rapid and characterized by numerous islands with side channels or 'sloughs.'

Upper Arrow lake is about 36 miles long and has a nearly uniform width of about two miles. To this must be added the Northeast arm, about ten miles long and one mile wide. The maximum depth exceeds 700 feet. The river connecting the Upper and Lower Arrow lakes is 18 miles in length. It is a wide, tranquil stream, easily navigable by steamers, though there are two unimportant rapids, one, two miles from Lower Arrow and the other, eight miles from the Upper lake ; the latter appears only at low water. Lower Arrow lake is 51 miles in length. It is shaped like a bow, seldom exceeds a mile and a half in width and tapers towards each end ; it is not so deep as Upper Arrow and, at high water, a current is perceptible at several points.

The Canadian Pacific steamers run from Arrowhead to West Robson. The river is navigable by stern-wheelers from West Robson to the international boundary—about 30 miles—and to the Little Dalles, 19 miles south of the boundary. (See Plate 20, which well illustrates the Columbia river as it approaches the international boundary.)

In the main valley there is a considerable area of fruit-growing land but, for the most part, it is confined to comparatively narrow benches of varying extent and altitude, sometimes on one side only and sometimes on both sides of the waterway. In many places along the lakes the mountain slopes ascend steeply from the water, while at other points rise steep bluffs. As a rule, the belt of cultivated land does not extend above 2,000 feet, sea level elevation, 600 feet above the Columbia. At one time the whole watershed was heavily timbered, but fire has deforested large areas and much of the country is covered with a smaller second growth.

The precipitation in the valley is heaviest at the north end, averaging over 40 inches at Revelstoke, and gradually decreases towards the south to less than 30 inches near the boundary. These figures, however, apply only to the immediate valley of the river. Each of the more important and higher mountain masses becomes a separate centre of precipitation and, at the head-waters of the Illecillewaet, which falls into the Columbia near Revelstoke, the precipitation approaches, if in fact it does not exceed, 100 inches. Generally speaking, the precipitation during the growing period is sufficient to ensure

crops, but, at a few points, where water is within easy reach, emergency irrigation systems have been installed for use in times of drought. (See plate 17.)

As the Arrow Lakes watershed is narrow, the tributaries are, with a few exceptions, small. Many of them, however, contain good power possibilities for local uses, and the valley is well supplied with undeveloped water-power. Particulars of some powers will be found in the tables, but the list is not exhaustive. In the vicinity of Revelstoke there are several undeveloped water-powers in addition to that on the Illecillewaet river utilized by the city.

Okanagan River

In ascending the Columbia, the Okanagan river is the first tributary encountered which drains a portion of British Columbia. The total area of the Okanagan watershed is about 8,350 square miles, of which 6,000 square miles, or 72 per cent, lies north of the international boundary. Osoyoos lake, on the boundary, at an elevation of 913 feet, is the lowest point of the Columbia watershed in British Columbia. Okanagan lake is 69 miles long and has an average width of nearly 2 miles. Its high water elevation is 1,130 feet and low water, 1,125. Portions of the shores of the lake rise steeply from the water's edge to mountains of considerable height. There are, however, many stretches of flat land bordering the lake and about the north end is an extensive region characterized by broad, open valleys, separated by lower ranges of hills, and, agriculturally, Okanagan Lake district is the most highly developed area in the interior. It contains the most extensive fruit-growing area in the province.

The watershed of the Okanagan river lies in the dry belt. The timber is mostly of moderate size and scattered, with large areas of open bunch-grass country. In some of the more arid portions there is practically no vegetation, but, near the headwaters of the tributary streams, the timber is fairly heavy.

Irrigation requirements in this district are of primary importance, and many companies have been formed. Extensive systems have been installed and others are projected. (For types of irrigation structures see Plate 12.)

The mountains in the watershed rise from 4,000 to 7,000 feet above sea-level, and in places there is a fairly heavy fall of snow. As a result, some of the streams draining the more elevated areas have a relatively large flow till summer is well advanced. Generally speaking, however, the runoff is rapid, and extensive storage will be necessary to ensure the best agricultural development. The use of a stream for irrigation does not, necessarily, prevent its use for power, but it may modify the conditions under which it is so used. In most cases, power development would be subservient to irrigation requirements. Owing to topographic features, irrigation reservoirs have frequently to be constructed at a considerable elevation, and the head available between the outlet and the point of use may in some cases be utilized to develop small powers. On Okanagan river a small low-head development is possible at the falls below Dog lake.* Many of the tributaries have steep grades and high heads, but the small flow and the increasing demand for water for irrigation will limit power development.

* For illustration of Okanagan falls, see *Sixth Annual Report*, Commission of Conservation, Ottawa, 1915, p. 8.

Similkameen River Watershed

The Similkameen river is the chief tributary of the Okanagan. Its watershed area is about 3,750 square miles, of which 2,950 square miles are in British Columbia. The Similkameen rises in the mountainous district east and southeast of Hope. It flows north to Princeton: thence, southeast to Keremeos; thence southward and eastward, falling into the Okanagan at Oroville, a few miles south of the boundary. The whole district is a mountainous one, the streams flowing, for the most part, in narrow V-shaped valleys.

The western portion of the watershed is fairly well timbered. The southern slopes of the hills are open and grassy, with scattered timber; the northern slopes are more thickly wooded. In the vicinity of Keremeos, sage-bush grows on the benches, while bunch-grass is found throughout the district. The climate of the watershed varies considerably, but is generally of the dry-belt type, and the land requires irrigation. The agricultural land is confined to the bottom of the valleys. The chief area is between the international boundary and a point two miles west of Keremeos; here the valley has an average width of one and one-half miles. The bottom land adjacent to the river requires little or no irrigation, but the bench lands on either side afford opportunity for extensive irrigation projects. South of Susap creek the benches on either side of the river narrow down and are more or less broken.

From a point two miles above Keremeos to about three miles below Princeton—approximately 38 miles—the Similkameen valley is narrow, varying in width from 300 feet to three-quarters of a mile, its average width being about one-quarter mile. The river is tortuous and generally margined by narrow, arable benches 75 to 100 feet above the river, above which the mountains rise steeply to an elevation of 4,000 to 6,000 feet above sea-level. Three miles below Princeton the valley opens out in a plateau-like basin, which also extends northward from Princeton for six or eight miles. Five or six miles south of Princeton the valley again narrows. From the boundary to Keremeos the grade of the Similkameen is small and the flow sluggish. In the cañon-like valley between Keremeos and Princeton the grade averages about 19 feet per mile. From Princeton, where the elevation of the river is 2,090 feet, to Whipsaw creek, the average grade is about 30 feet to the mile. Above Whipsaw creek, to the confluence of the Pasayten, the fall is about 75 feet per mile. About one and one-half miles below the mouth of the Pasayten are falls and rapids in a cañon, with total reported fall of nearly 80 feet in a distance of 200 feet.

There is relatively little storage possible in the Similkameen watershed, and the flow of the river fluctuates considerably. Measurements by the Daly Reduction Co., above the confluence of Twenty-mile creek, show a discharge in the winter as low as 270 second-feet.

The principal use made of the tributary streams in the Similkameen watershed is for irrigation. The large extent of irrigable land in the vicinity of Keremeos, and the favourable climatic conditions, have so encouraged the cultivation of land that the normal minimum flow of Keremeos creek is nearly all utilized. Water is also brought eight miles from the Ashnola river.

The Daly Reduction Co's plant, near Hedley, is the chief power development on the Similkameen. By means of a dam and flume three miles long a head of 67 feet has been developed for a plant of 2,000 horse-power. A noteworthy point about this development is that, to secure a head of 67 feet, three miles of flume were necessary. (See Plate 5.) It supersedes a plant on Twenty-mile creek, which developed 800 horse-power under a head of 420 feet, but, owing to the uncertain flow, a steam auxiliary was necessary.

The chief tributaries of the Similkameen are the Ashnola and Tulameen rivers. It is proposed to develop power on the former. South of the boundary, at Similkameen falls, there is a hydro-electric plant which has recently been acquired by the Okanagan Valley Electric and Power Co., in connection with plans for an electric railway between Oroville and Penticton. It is stated, the company proposes to develop these falls to their fullest extent.

Kettle River

The Kettle river drains an area consisting chiefly of minor mountain ranges lying between the Okanagan and Lower Arrow lakes. The total drainage area is about 4,260 square miles, of which about 3,160 square miles, or 74 per cent, lies in British Columbia. The total length of the river is about 170 miles. In the vicinity of the international boundary it crosses the boundary line three times, then flows south, falling into the Columbia near Marcus, Wash.

Much of the country in the upper part of its watershed is very rough and broken, with deep gorges and rocky bluffs. The rivers flow in valleys of varying widths ; generally speaking the bottom lands are from about one-half mile to two and one-half miles wide. In addition to the bottom lands, there is a considerable area of good bench lands suitable for agriculture. The character of the forest cover in the Kettle River basin varies. Near the international boundary the quantity of timber is comparatively small, the growth open, and, in many places, the hills are almost bare. The northern portion of the watershed is heavily timbered and lumbering is an important industry—the total drive in 1913 on the Kettle and its tributaries having exceeded 20,000,000 feet. Forest fires have done considerable damage to many areas.

Owing to the very irregular formation of the country, precipitation varies between wide limits. Sufficient data are not available to give an adequate estimate of the precipitation, but, approximately, the annual fall in the valleys to the south is 15 to 18 inches, in the higher valleys from 18 to 22 inches, and on the hills and plateaux from 22 to 30 inches or even more. At the higher elevations a larger proportion falls as snow and, at some points, nearly 20 feet of snowfall is reported. All the snow, however, on these minor ranges melts during the summer, and by late autumn the waters of the creeks are low. In the larger valleys, especially to the south, in what is known as the 'Boundary district,' irrigation is necessary and is extensively employed. In other parts the precipitation in normal years is sufficient for agricultural purposes. Grand Forks is the centre of a splendid fruit growing industry and, in the vicinity of Cascade, there is a considerable area of agricultural land. (See Plate 13.) Although merchantable timber is not met with in large quantities in the south, there is frequently a dense growth of smaller trees on the potentially better

agricultural land. The cost of clearing such land, and the need of investment for irrigation, retard its development.

From an irrigation point of view the locality has a good water supply; but the construction of expensive irrigation works is justifiable only where considerable areas can be brought under cultivation.* An interesting development in this connection is the installation along the main river of small pumping plants for irrigation. Some of these plants are driven by gasolene engines, and others by electric power, which is available at about three cents per kilowatt hour. Many parts of British Columbia offer a wide field for the application of power for pumping for irrigation.

Mining is of great importance in the Kettle River district, and the streams are extensively used in connection with this industry. Kettle river is developed to some extent for power. Plants are installed at Cascade, Grand Forks and Boundary Falls. Its upper waters and its tributaries no doubt afford numerous possibilities for small developments to meet local requirements. There are no large lakes, and no known extensive storage possibilities. The flow varies between wide limits and the low-water flow is small.

Pend-d'Oreille River Watershed

The Pend-d'Oreille river—or, as known in the United States, Clark fork—is the second largest tributary of the Columbia. It drains a watershed of approximately 25,820 square miles—24,630 square miles in the United States and 1,190 square miles in British Columbia.

The watershed of the Pend-d'Oreille is a region of great mountain ranges and extensive valleys, largely forested, and, south of the boundary, lumbering is an important industry. (See Plate 16, showing forested valley.) The climate varies widely, ranging from the arid and semi-arid areas in the Bitterroot and Flathead valleys to the regions of copious precipitation, greatest on the higher western slopes of the more massive mountain ranges. Altitudes within the basin range from about 1,350 feet at the mouth to over 8,000 feet on the continental divide. Scarcely a dozen of its 150 tributaries are entitled to be called rivers. In British Columbia the only important tributary is the Salmon, which drains an area of 480 square miles.

The total length of the Pend-d'Oreille is about 420 miles, but only the last 16 miles of its course are in British Columbia. Profile surveys of the river have been made in Washington, Idaho, and Montana.† The fall in British Columbia between the boundary and its mouth—sixteen miles of narrow cañon-like valley—is 400 feet. (For view of Pend-d'Oreille river, in vicinity of Salmon river, see Frontispiece.)

The flow of the Pend-d'Oreille and of some of its tributaries has been the subject of special study by the Water Resources Branch of the U.S. Geological Survey. Recently the Water Resources Branch and the British Columbia Hydrometric Survey have co-operated in establishing a station near its mouth.

* A proposal has been under consideration to utilize water from the Kettle river by a gravity scheme which would involve making the diversion at a point situated in the United States about 10 miles upstream from Carson Bridge.

† See *Water Supply Paper No. 346*, U.S. Geological Survey, Washington, D.C.

The Pend-d'Oreille has a more uniform flow than either the Columbia above the confluence of the Kootenay, or the Kootenay itself. This is doubtless due in part to the regulating control exercised by the three large lakes and the numerous smaller ones on its watershed. Flathead lake, in Montana, is about 20 miles long and 15 miles in maximum width, with an area of 175 square miles. It is 2,916 feet above sea level. Pend-d'Oreille lake, in Idaho, is on the main stream; its area is 125 square miles and its elevation is 2,051 feet. Priest lake, on Priest river, is 19 miles long, with an area of 35 square miles,* and its elevation is 2,439 feet.

In British Columbia the Pend-d'Oreille, with its total fall of 400 feet in less than 16 miles, affords exceptional opportunity for extensive power development. As there are, however, no distinctive falls greater than about 10 feet in height, the available fall would need to be concentrated by means of dams. There are four or five chief suitable sites. Under natural conditions the river, in places, has a range between high and low water of over 20 feet. Special provisions would be necessary for handling the flood water, which, in the high-water year of 1913, attained a maximum discharge flow of 129,000 second-feet, or about 16 times the ordinary minimum flow. With ordinary low-water flow there is, in the portion of the river in British Columbia, theoretically available, at 80 per cent efficiency, about 300,000 horse-power.

In the state of Washington, between two and three miles south of the boundary, the Pend-d'Oreille falls 60 feet in a distance of a mile; at Metaline falls, 11 miles south, there is a fall of 20 feet in a short distance and the total descent between the crest of Metaline falls and the boundary is 225 feet.

Kootenay River Watershed

The Kootenay river is the third largest tributary to the Columbia and, in British Columbia, the most important. Its total drainage is somewhat smaller than that of the Pend-d'Oreille, being 19,450 square miles, of which 14,550 square miles are in British Columbia, and 4,900 square miles in the United States. Like the Pend-d'Oreille, it drains a watershed of very diversified character, varying from the arid, or semi-arid, district near the Tobacco plains, at the southern end of the Intermontane valley, to the region of heavy precipitation, with correspondingly dense forest cover, found on the western flanks of the Selkirk mountains, and including, at higher elevations, extensive snowfields and glaciers.

For descriptive purposes it is convenient to divide the watershed of the Kootenay river in British Columbia into three portions; first, that north of the international boundary and between the Rocky mountains and the Selkirks; second, the area tributary to Kootenay lake; third, the portion occupying the transverse valley between Kootenay lake and the Columbia.

The first portion is in the district known as East Kootenay, and occupies the southern portion, in Canada, of the great Intermontane valley. A little north of Cranbrook the valley attains its greatest width. It is here about 20 miles, and the greater portion of it has an elevation of about 300 feet above the river. The low bottom land rarely exceeds a mile in width. The main valley is bounded on the east, at a distance of from two to four miles, by the

* General Land Office Map of Idaho, 1913. Scale, 12 miles to 1 inch.

Rocky mountains, which rise abruptly, and, on the west, by the Selkirks, which ascend more gradually. On both sides the mountain systems are deeply penetrated by lateral valleys drained by important tributaries of the Kootenay. These tributaries occupy deep, narrow valleys and follow a winding course among the ranges of the Rockies and Selkirks. The Kootenay river itself, above Canalflat, occupies one of these valleys. With the exception of the areas that have been cleared for ranches, and two or three areas of prairie—for example, the St. Mary prairie on St. Mary river—the whole of the Kootenay valley is here covered with an open park-like growth of large trees. The mountain slopes, except where too precipitous, and the watersheds of the tributaries are, as a rule, more thickly timbered.

Irrigation, except in years of exceptionally heavy precipitation, is necessary and is extensively practised. There is a large area of agricultural land in the district and stock-raising and mining are important industries.

There are no power sites on the main stream below Canalflat, but the district is otherwise well supplied with potential water-powers, some of which have been developed in connection with mining operations. The two largest undeveloped sites are those on Elk river and Bull river, particulars of which are given in the tables. (For typical views on these and other streams see Plate 14.)

The second great valley drained by the Kootenay river contains Kootenay lake and its tributaries. Kootenay lake is 66 miles long, about two miles wide in the northern part and three miles wide in the southern; it has an area of 170 square miles and is one of the larger lakes of the province. The West arm is 18 miles long and from a half-mile to a mile wide. The northern portion of the lake and most of the southern is closely bordered by mountains, rising more or less steeply from the lake shore to 6,000 feet above the lake. There is comparatively little low-lying bench land. Many of the mountains are somewhat rugged in outline, showing much bare rock, and abrupt rocky bluffs and cliffs frequently margin the lake. There are many sandy or gravelly beaches of limited extent at the mouth of tributary streams. At the north end of the lake an area of flat land, two miles wide, extends northward about five miles, to the bifurcation of the main valley. Lardeau river drains the western branch and Duncan river drains the eastern.

Kootenay lake has a great variation in level between high and low water. The average difference of level is about 19 feet, but in 1894 it rose some 32 feet.

The Kootenay river enters the lake at its southern extremity. In this vicinity there are extensive areas of flat land, extending on both sides of the international boundary, which are subject to overflow. In order to make these areas available for agriculture, proposals have been made to straighten and dyke the river at this point, and also to reduce the fluctuations of the lake level by enlarging the outlet.

There are numerous mountain streams, tributary to the lake and to the Duncan and Lardeau rivers. Some of them are utilized to a limited extent for irrigation and on most of them there are power possibilities. There is a marked increase in precipitation towards the northern end of the valley.

The third portion of the Kootenay watershed, and, from a power point of view, the most important, is the transverse valley between Kootenay lake and the Columbia river. This valley is much narrower than the north and south valleys which it connects. Throughout its length it maintains a uniform trough-like character and is bordered by steep, wooded or rocky, mountain slopes. The rocky bed of the valley is little below the present level of erosion; this is particularly apparent on the lower portion of the river, about Bonnington falls, and near the outlet of the lake, where the banks are frequently of solid rock. The upper portion of this valley is occupied by the West arm of Kootenay lake, near the western extremity of which is the important city of Nelson. From the first rapids below Nelson to its mouth the river is a succession of rapids and falls. (For view showing falls and stretch of lower rapids on Kootenay river, see Plate 15.) The flat land, also the bench land along the Kootenay river below Nelson, has been extensively developed for fruit-growing, for which it is exceptionally well adapted. The Doukhobors have large holdings in this locality, also in the vicinity of Grand Forks, B.C.

The Slocan river is the only large tributary to the Kootenay below Kootenay lake. It rises in Slocan lake and is 30 miles long. It is a rapid stream, and, with the exception of one stretch of eight miles, and another of four miles immediately below the lake, can be ascended in a canoe only by poling. Slocan lake is 25 miles long and has an area of 24 square miles. In this district the general elevation of the mountain summits is 6,000 to 7,000 feet, but there are numerous rugged peaks, notably between Slocan and Kootenay lakes, which exceed 9,000 feet. The slopes of the mountains are, in general, densely wooded, but considerable damage has been done by forest fires. Above 5,000 feet the forest becomes more open and of smaller growth, although trees are still found up to about 7,500 feet, which elevation may be considered the timber line in this district.*

The portion of the Kootenay river between the lake and the Columbia valley is one of the chief water-power streams of the province. In this distance of 20 miles the river descends about 330 feet. The chief descents occur at Upper Bonnington and Lower Bonnington falls, which have been partially developed. (See Plate 15.) These developments, however, divert but a portion of the flow by wing-dams, and no attempt is made to utilize the storage possibilities of Kootenay lake. The chief value of any control over the lake level would be in equalizing daily or short period fluctuations in demand for power and, for this purpose, a comparatively small difference of level would suffice. The present developments on the Kootenay river are described on pages 163 and 170, and also in the tabulation of power sites.

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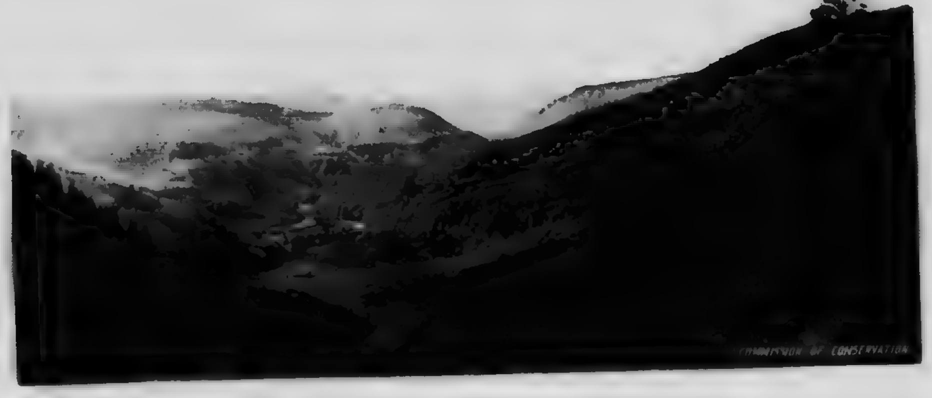
* See "Report on a portion of the West Kootenay District," by G. M. Dawson, in *Report of the Geological Survey of Canada*, 1888-1889 (Vol. IV) pp. 20, 21B.

Plate 22



CHILCOTIN RIVER

A.—View looking up valley from point twelve miles from Chilcotin post office.
B.—Confluence of Chilcotin river and its chief tributary, the Chilko.
C.—Cañon near mouth of Chilko river. A possible power site.

Description of Power Site Tables

Until recently comparatively little information respecting the water-power possibilities in British Columbia was available. As late as 1911, the official *Year Book of British Columbia* stated that : "Speaking generally, there is no subject of economic interest, in connection with the exploitation of the provincial resources, concerning which there is less known than the extent to which water-powers may be rendered available."

Owing to the topography of British Columbia and the relatively small extent of territory covered by detailed topographic and hydrometric surveys, it is practically impossible to make anything like a close estimate of many of its water-power possibilities. Both the confines of the watersheds of many of the smaller streams and their run-off are unknown. In such cases, any figure purporting to give the available amount of power is, at best, only an estimate indicating possibilities.

The "power tables" contain summarized statistical data regarding the water-powers. It is not practicable to indicate all details of information upon which the tabular estimates are based, but all available data have been used. Effort has been made to keep on the conservative side, and totals for the province, based on the tabulated estimates, can only fairly be compared with estimates for other large territories by taking into account the conservative character of the deductions.

The power sites are arranged in five groups :

I. The Columbia River and Tributaries, north of the international boundary : This comprises the portion of the province lying between its eastern boundary and the watershed of the Fraser. For convenience, the Skagit river and its tributaries are also here included.*

II. The Fraser River and Tributaries : This includes practically the entire area of the great Interior plateau.*

III. Vancouver Island.

IV. The Mainland Pacific Coast and Adjacent Islands (except Vancouver island): This includes all the rivers north of the Fraser which drain into the Pacific. They are dealt with from south to north.

V. The Mackenzie River Tributaries.

The power sites are listed in order of ascending the streams, and each main stream is disposed of before its tributaries are dealt with.

The power sites in the Railway Belt are under the jurisdiction of the Dept. of the Interior, but are now administered by British Columbia Dept. of Lands.

Names of certain rivers and creeks vary on different maps. Where decisions of the Geographic Board were not available, the form given on the latest published map was adopted.

The tables indicate situation, approximate watershed area, possible head, and estimated magnitude of the respective powers. The column of 'Remarks'†

* In the Tables of Power Sites in Chapters X and XI, sites on streams in the Railway Belt have been indicated by a "†" attached to the number.

† In the tables it will be noticed that certain descriptive memoranda have been supplied, even where no estimates of power have been given. Although available data did not, in all cases, warrant making estimates, such data, by indicating certain characteristics of these streams or sites, may prove useful. Consequently, such fragmentary data have been recorded, even though their inclusion gives the tables the appearance of incompleteness.

supplies supplementary information respecting head, rapids, character of banks, ownership, etc., etc.

Situation In the first column is given the name of the stream and the situation of the power site. An index number, corresponding to numbers upon the accompanying map, precedes each power or group of powers.

Watershed In the second column, headed 'Watershed,' is given the approximate drainage area in square miles. Unless otherwise indicated, the figure represents the drainage area above the proposed intake of the power site. In other cases, a small 'x' indicates that the area given is the total watershed area above mouth of stream. A small 'y' indicates that the area given is the watershed area above the outlet of the lake. The accuracy of these watershed areas varies greatly, but they have been obtained from the best available maps, supplemented by information from other sources.

The maps published by the Geographic Branch of the Dept. of Lands, Victoria, B.C., are a great advance upon those published prior to its organization. A comparison with those published but a few years ago discloses many changes, due to new discoveries or to more accurate surveys. Other maps are in preparation and these will permit of more exact measurements of drainage areas. (For list of maps see Chapter VIII.)

In the southern portion of the interior, and in southern Vancouver island, the topography has been well ascertained. A new map of Cariboo and adjacent districts, recently published, covers a large portion of the Interior plateau and the Fraser River watershed. In the mountainous districts of the interior, the densely timbered portions of northern Vancouver island and of the Pacific coast, and in the largely unexplored territory of the north, the figures given for areas, except in a few cases where special surveys have been made, must especially be considered as approximations. In general, the percentage of error is less in the larger than in the smaller areas.

Head The column 'Approximate head in feet' may give the natural head, the possible head, or the developed head. The statements made under the column of 'Remarks' must be considered in connection with the figure relating to 'Head.' Heights of banks and distance between them were usually estimated. Distances along the streams were generally estimated by pacing or by time. The amount of head available is, in many instances, optional, but, for the purposes of estimating, it was necessary to select a specific head, and such selections are tabulated.

Wherever possible, the heads were measured by instrumental levelling, or by hand levelling, or with a tape line. In most instances, however, especially on rivers with steep gradient, or on those coursing through deep cañons where it is impracticable to proceed along the river bed, the aneroid barometer* was used.

* Where the aneroid barometer was used by field parties in securing reconnaissance data, a 5-inch instrument, reading on the vernier to single feet, was employed. Along the coast, it was customary to leave one aneroid at sea level on the survey boat, having it read every hour during the absence of field parties. These readings were then plotted to show the variation at sea level and, on the same sheets, for comparison, the river elevations were also plotted,—the times being carefully noted. Wherever possible, two readings were taken at the same place, either by two aneroids, or else by a second reading on the return trip. Consult also *How to Use the Aneroid Barometer*, by Edward Whymper, London, 1891.

In many instances data were supplied in answer to enquiry sent by mail. In such cases also allowance must be made for the 'personal factor.' Though all available data have been carefully sifted, the heads given must be regarded as approximations and, frequently, as optional.

Estimated Horse-power

In the column headed 'Estimated horse-power' the quantities given represent, generally speaking, the horse-power that could be developed at the respective sites, under the given head, and when utilizing the mean flow estimated to be available during average low-water months.

Numerically considered, and if developed, a large proportion of the British Columbia water-power sites, especially those on the smaller streams east of the Coast range or at high elevations, would, on account of low water or ice conditions, be practically inoperative for one, two, three or more months of the year. It is not possible, here, to take into account curtailment of operation such as might occur due to winter conditions. As each power site comes into a position of real economic importance, means of coping with such difficulties as ice will, no doubt, be devised. The Revelstoke plant, on the Illecillewaet river, for example, has been in successful operation for several years. Though, at times difficult ice conditions have been met, these have been overcome, and each winter the experience gained results in lessened damage and interruption.

With respect to the smaller individual powers, there is not sufficient information to permit discrimination but, in dealing with the situation as a whole, it has been concluded that, from the standpoint of service, the power possibilities of the smaller streams may be regarded, in a preliminary survey at least, as on a seven to nine, rather than on a twelve, months' basis. For example, in the case of the city of Nanaimo's plant, on the Millstone river, for six months of the year the water-power is supplemented by steam. The utilization of steam, gas, oil and other auxiliary power is a subject which is deservedly receiving more and more attention.

For the smaller streams, therefore, the column giving the estimated horse-power must be regarded as indicating, usually, the power for periods less than a year. Of course, where storage is available, each power affected thereby would have to be specially considered on its own merits. In many instances, especially in the cases of the smaller streams, the estimated power could not be obtained during part of the year without the utilization of some storage. On the other hand, at certain seasons, much more power than is indicated might be developed.

If, in addition to such general storage facilities as each individual case demands, additional means exist for locally storing the flow for perhaps half a day, practically double the listed horse-power would be available for the remainder of each day. In some of the estimates in the tables, weight has been given to known storage possibilities. Such allowances, however, do not necessarily represent the increased power that might be obtained by a complete development of possible reservoir sites.

Estimated quantities are on the basis of 24-hour power, 80 per cent efficiency. If comparison is made with other estimates of horse-power giving *theoretical* quantities, then our estimates should be increased 25 per cent.

Hydro-electric developments in British Columbia, such as those at lake Buntzen, Jordan river and Stave falls, would not have attained their present commercial serviceability without the employment of storage facilities. Without the knowledge of such storage, which was only obtained after extensive surveys and research, any estimates on the same basis as our tables would have been lower than the power actually produced under development. This fact is mentioned to show that, if the powers are to be dealt with individually and for special purposes, then physical data of a more precise and special nature than those resulting from reconnaissance investigations are demanded. Such factors as glaciers, snowfields, precipitation of exceptional character and amount, and storage possibilities emphasize the necessity for submitting to very careful engineering investigation any contemplated power development in British Columbia.

Columbia River and Tributaries—District No. I

Name of Stream and Situation of Power Site	Area of watershed in square miles*	Selected head in feet*	Estimated horsepower*	Remarks
Columbia river—'Big Bend'‡:				
†1 Revelstoke cañon	10,400	25–30	12,000	Cañon and gorge 5m. long. Dam-site at lower end. Head optional. Possible back flooding.
2 Twelve-mile, Death and Priest rapids	9,530	40	15,000	Total drop 40 ft. in about 2½m. River narrow between steep mountains. Banks alternate steep bluffs and rock slides.
3 Rapids below Canoe river	8,370	20	6,000	Fall of 29 ft. in 3m. Part of this might possibly be developed by a dam in gorge 8m. below mouth of Canoe river.
4 Long rapids§ (Below outlet of Kinbasket lake)	6,020	150	30,000	Descent, 256 ft. in 16m. River is generally less than 300 ft. wide; many patches of sliding bank and bluffs; rapids usually over heavy boulders and rocks. Reef rock in bed above Cummings creek, near Yellow creek, in Red cañon, and probably at other places. Some possible power sites reported; heads would depend on height of dam.
†5 Surprise rapids (Below mouth of Bush river)	5,425	100	17,000	1st drop, 21 ft., in 750 ft.; 2nd., 14 ft. in 1,200 ft.; 3rd., 25 ft. in 5,000 ft. Total fall, 95 ft. in 3.3m. Rocky bluffs and gravel benches with reef rock at places in stream.
†6 Kitchin rapids (near Beavermouth)	4,170	20	2,500	9.5 ft. fall in 1,000 ft.; total fall, 24 ft. in 9,250 ft.; heavy boulders in bed; reef rock shows in upper part of bed and in bank.
†7 Donald cañon (near Donald)	4,000	20	2,500	15 ft. fall in 8,000 ft. At cañon, banks largely bluff and almost wholly reef rock; width at upper end about 75 ft.
OKANAGAN RIVER AND TRIBUTARIES				
Okanagan river:[1]				
8 Okanagan falls	2,545	16	750	Direct fall 8 ft. and 8 ft. head in 150 ft. rapids. Limited storage, probably up to high-water mark only in Dog lake, and possibly some storage on Okanagan lake.
Similkameen river:				
9 Rapids 3m. above Keremeos	2,960	25 ft. per m	1,000	Series of small rapids, 25 ft. per m.; difficult to develop.
10 Rapids 10m. west of Hedley	....	75	2,000	Proposed development by Ashawata Power Co., 70ft. dam.
10 Development by Daly Reduction Co.	2,040	67	1,800	Head of 67 ft. developed by dam and 3m. wooden flume. Supplies power for mines and lights town of Hedley. Hedley Creek plant used as auxiliary. (See below.)
Princeton to Whipsaw creek	....	...	.....	Grade 30 ft. per m. Valley wide in places; high benches to west.
Whipsaw creek to Pasayten river	....	....	.....	Grade 75 ft. per m. in narrow, rocky valley; box cañon in places.
11 Rapids and falls 1½m. below Pasayten river mouth	480[2]	80	1,750	80 ft. fall in 200 ft. Heavy rapids above and below falls
[3]Above junction with Pasayten river	160x	....	.....	Grade of 75 ft. per m.; reported no good power sites. Rises 900 ft. in 12m. (G.N.Ry. survey.)

*See Description of Power Tables.

‡The particulars of the various rapids around the 'Big Bend' were taken from a report by W. F. Richardson to the Dept. of Public Works, Canada, *re* Columbia River surveys, 1912. The survey had reference to improvement of navigation and the report does not specify the best locations for dams. Consult, also, "Notes on the Geography and Geology of the Big Bend of the Columbia" by A. P. Coleman, in *Proceedings and Transactions of the Royal Society of Canada*, Vol. VII (1889), Sect. IV, Pt. VIII, pp. 97-108—especially 99-102.

†Power sites on streams within the confines of Railway Belt.

§Below Kinbasket lake, the water surface profile is as follows:

From 0 to 1½	miles,	descends	37.8 feet.	From	9 to 10	miles,	descends	13.6 feet.
" 1½ to 3	"	"	26. "	"	10 to 11	"	"	8.7 "
" 3 to 4	"	"	31. "	"	11 to 12	"	"	20.2 "
" 4 to 5	"	"	11.5 "	"	12 to 13	"	"	9.2 "
" 5 to 6	"	"	13.5 "	"	13 to 14	"	"	9.9 "
" 6 to 7	"	"	13.2 "	"	14 to 15	"	"	8.1 "
" 7 to 8	"	"	12.5 "	"	15 to 16	"	"	16.2 "
" 8 to 9	"	"	25.2 "					

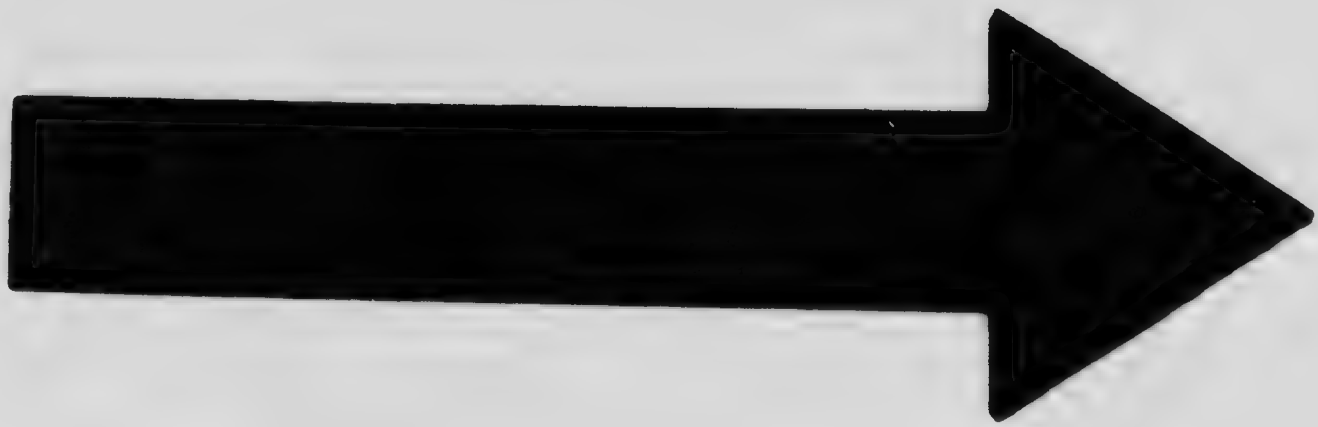
Assumed for purposes of estimate, see under column Remarks.

[1]With reference to the possible water-powers in the Okanagan River watershed it must be remembered that irrigation interests are of primary importance. The use of a creek for irrigation does not necessarily prevent its development for power, but may modify the conditions under which it is useable.

[2]In Washington about 260 sq. m., in British Columbia about 220 sq. m. Watershed area above Placer creek.

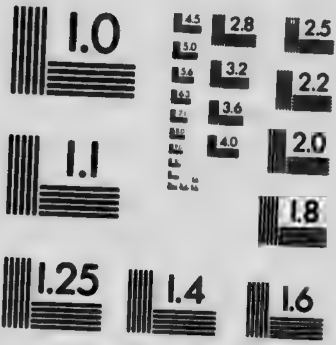
[3]This portion of Similkameen also called Roche river.

x Drainage area above mouth.



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—Continued

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
Suchumption (Nehumpshon) **creek** :	*	*	*	
12 Rapids and falls at foothills...	43	1,000	250	30 ft. direct fall, 820 ft. in 6,200 ft. rapids. Head optional. Proposed development by Southern Okanagan Power Co. River below power site used by Indians for irrigation.
Susap creek :				
13 Rapids and falls at foothills...	20	880	110	20 ft. direct fall; 880 ft. in 6,400 ft. rapids below forks.
Keremeos creek :				
14 Falls above White Lake road.	....	900	150	900 ft. fall in 4.3m. above road bridge. Below bridge the water is required for irrigation.
Ashnola creek :				
15 Lower cañon (1m. from mouth)	420	125	600	125 ft. fall in 1m. rapids; steep, rocky cañon.
15 Upper Cañon (6m. from mouth)	380	260	1,300	260 ft. fall in 1½m. Rugged cañon, steep cut banks, installation probably difficult. Above forks, main branch and South fork flow in narrow, rocky valleys with fall of about 75 ft. per mile.
Winters (Sixteen-mile) **creek** :				
16 Rapids above foothills........	10	900	40	900 ft. fall in 2m. above foothills; narrow, rocky valley, steep side hills. Below foothills water is used for irrigation.
Hedley (Twenty-mile) **creek** :				
17 Dam, 4m. from mouth.......	110	412	225	424 ft. head in 3m.; developed by Daly Reduction Co.; 800 h.p. installed for mining and milling. Power intermittent, creek sometimes dry in winter; steam auxiliary. Supplements Similkameen River plant. (See above.) Storage possible in Stray Horse lake.
Stirling creek :				
18 Rapids below forks..........	30	600	245	Grade below forks about 200 ft. per m.; above, 300-400 ft. per m.; narrow rocky valley. Head optional.
Smith creek :				
19 Rapids below swamp........	Small	450	40	450 ft. in 1st m. below swamp, then uniform grade of about 200 ft. per m. to mouth. Head optional.
Wulf creek..................	....	....	....	Reported no power sites; fall of 800 ft. in 12m.
Coldwater creek (trib. Wulf) :				
20 Power site just above mouth.. (Dam site, 3m. from mouth)	45	450	250	Dam 100 ft. high would back up water 2m. giving good storage. Below dam-site, 350 ft. fall in 3m.
Hayes (Five-mile) **creek** :				
21 Cañon near mouth..........	300	300	400	Falls 100 ft. per m. for 3m. below Red creek. Storage in lakes on Osprey creek.
Red creek (trib. Hayes) :				
22 Falls and rapids near mouth..	75	1,490	500	1,490 ft. fall in 2½m. Proposed development by Similkameen Power Co. Some storage possible above cañon.
One-mile creek..............	140x	....	....	Reported no good power possibilities; grade 70 ft. per m. for first two miles.
Summers creek (trib. One-mile) :				
23 Rapids above mouth.........	56	200	50	200 ft. head in 1,000 ft.; a small power possibility.
Tulameen river :				
24 Dead Horse falls............ (9m. above Tulameen)	175	60	500	60 ft. fall in ¼m.
25 Tulameen falls.............. (18m. above Tulameen)	30	230	320	130 ft. direct fall; possible total, 230 ft.
Granite creek (trib. Tulameen) :				
26 Rapids.....................	70x	....	....	Narrow rocky valley. No special sites, but small powers might be developed.
Otter creek (trib. Tulameen) :				
27 South fork of West fork near mouth..................	Small	....	....	A small development proposed on this stream.
Whipsaw creek :				
28 Rapids above mouth.........	90	420	1,500	420 ft. fall in 1m. above mouth; 100 ft. per m. above. Hydraulic sluicing plant installed.
Lamont (Nine-mile) **creek** : (trib. Whipsaw)				
29 Rapids near mouth..........	16	250	75	250 ft. fall in 1m.
Copper creek................	40x	....	....	Grade of 100 ft. per m. but no good power sites.
Pasayten river...............	310x	....	....	Grade of 75 ft. per m. for 10m. but no special power sites.
Incaneep creek :				
30 Rapids....................	110	300 per m.	300	Creek has low grade for 2m. above mouth, then rises 300 ft. per m. for several miles. Head optional.

* See Description of Power Tables.
x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Reed creek	Small	....	....	Water all recorded for irrigation interests and by Stemwinder Mining Co.
Meyers creek	74x	....	....	Water all recorded for irrigation.
McIntyre creek:				
31 Proposed development	33	300 per m.	90	Southern Okanagan Power Co.'s power site; between Sheep creek and S. fork; fall of 300 ft. per m. Head optional. Near mouth, water is all recorded for irrigation.
Shuttleworth (Keogan) creek	27	....	....	Water required for irrigation. Has small storage at head-waters; 1,200 ft. fall in 4m.
McLean creek:				
32 Fall in box cañon (4m. from mouth)	65	400	225	15 ft. fall; 350 ft. per m. in box cañon; water below falls required for irrigation.
Ellis creek:				
33 {North Fork diversion	38	1,600	85	Proposed development; 1,600 ft. fall in 5 miles.
33 {Ellis Creek diversion	....	1,300	350	1,300 ft. head in 5m. Diversion at rapids just above E. boundary of lot 3,639. Water below power site used for irrigation.
Penticton creek:				
34 Diversion 9m. from mouth (Power house, 2m. from mouth)	80	2,100	500	2,100 ft. fall in 7m. Town of Penticton commenced development but abandoned it as too expensive. Irrigation storage reservoir, 18m. up.
Shingle (Beaver) creek	....	....	....	100 ft. fall per m. for 10m.; 200 ft. per m. for 4m. Water diverted 11m. up and carried over a divide into Marron lake for irrigation.
Four-mile creek (trib. Okanagan lake)	Small	....	....	Used for irrigation.
Naramata creek	Small	....	...	1,140 ft. fall in 2m., but water all used for irrigation.
Mill creek	Small	....	....	1,000 ft. fall in 1m. and 600 ft. in 1m. Used for irrigation.
Lequille (Wildhorse or Chute) creek:				
35 Rapids and falls	....	2,600	....	1,000 ft. fall in 1m.; 400 ft. in 1m.; 300 ft. per mile for 4m. Chute lake, elevation 3,900 ft., area 80 acres, affords storage. Water rights held for irrigation.
Trout creek:				
36 Cañon creek tributary	....	....	....	Proposed small development by Summerland municipality.
Peachland (Deep) creek	[illegible]	....	....	Small creek used for irrigation.
Trepanege river:				
37 Peachland Municipal plant (1m. from mouth)	70	184	60	Small lighting plant; 184 ft. head developed by 6 ft. dam. All water used at low stage. Proposed to construct 50 ft. dam to give limited storage. Total possible head about 290 ft.
Power creek	....	....	....	700 ft. fall in 5m. All water used for irrigation.
Mission creek:				
38 Proposed development (By Belgo-Canadian Fruit Lands Co.)	175	450	[illegible]	450 ft. head in 2m. rapids; dam 10m. from mouth; power-house 12m. from Kelowna; initial development 1,000 h.p.; ultimate development 2,000 h.p. Power for pumping for irrigation, also lighting of Kelowna.
Lumby (Bear) creek:				
39 Fall ½m. from mouth	115	960	[illegible]	Direct fall 35 ft.; 960 ft. head in 5m. Proposed to develop power here. Water mostly required for irrigation.

KETTLE RIVER AND TRIBUTARIES

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Kettle river:				
40 West Kootenay Power & Light Co.'s plant No. 3 (Formerly Cascade Water Power and Light Co.) Plant in gorge 12m. below Grand Forks.	3,600‡	156	4,000	Natural head of 120 ft. in ½m.; series of rapids and falls in gorge; dam 36 ft. at head, 700 ft. rock cut and 400 ft. tunnel to 7 ft. diam. steel pipe; 3 turbines of 1,300 h.p. each; auxiliary to Bonnington Falls plant. Power used at Grand Forks, Phœnix and Greenwood.
41 Cañon 6m. north of Cañon City	[illegible]	[illegible]	175	Direct fall 10.5 ft. Possible total head, by dam and 1,500 ft. flume, 30 ft.§

* See Description of Power Tables.
‡ In Canada about 2,870 sq. m., in United States about 730 sq. m.
§ *Report of Minister of Lands*, British Columbia, 1913, p. D166.
x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Sites	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Sutherland creek :‡	*	*	*	
(trib. Christina lake)				
42 Rapids and falls near mouth...	30	850	350	Small rapid mountain stream, 850 ft. fall in 2½m.
Granby (North fork Kettle) **river**:				
43 Development at Grand Forks. (Granby Mining, Smelting & Power Co.)	950	30	700	About 700 h.p. generated for power and light at Granby smelter.
Boundary creek :				
44 Greenwood City development. (Boundary falls 5m. from mouth)	50	130	180	Dam 24 ft. high, 30 ft. long ; 250 h.p. generated for lighting Greenwood. 2 Doble wheels.
Westkettle river :				
45 Cañon north of Wilkinson creek..................	165	40	120	Possible 40-50 ft. dam in deep, narrow, rocky cañon.§
45 Fall, 3m. above Lot 1,235 (S).	....	50	150	Direct fall 25 ft., in deep, rocky cañon, 20 ft. wide at falls.

PEND-D'OREILLE RIVER AND TRIBUTARIES

Stream and Sites	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Pend-d'Oreille river :‖				
46 Waneta Power site.......... (near mouth)	25,820[1]	100	73,000	100 ft. might be developed by 60 ft. dam in rocky cañon balance of head in ½m. of rapids below. Head optional
47 Nine-mile falls..............	25,810	44	32,000	
48 Site at Fifteen-mile creek.....	25,810	47	34,000	
49 Dam site near mouth Salmon river.....................	25,290	74[2]	50,000	
Salmon river :[3]				
(trib. to Pend-d'Oreille)				
50 Cañon just above mouth.....	475	35*a*	375	30 ft. rapids in about 1,000 ft.; rocky box-like cañon 40 50 ft. deep.
50 Rapids and cañon for 3m. above mouth	....	180	2,000	Proposed diversion on lot 9,282. This site includes a.
51 Rapid 1½m. south of Hall.....	57	30	40	30 ft. rapid in about ½m.; rocky banks 25 ft. high.
51 Rapid 1m. north of Hall......	27	30	20	30 ft. rapids in about ½m.; rocky banks.
Sheep creek and Wulf creek :				
52 Development by Queen mines				
Sheep creek..................	10	260	75	Creeks combined for power ; 260 ft. head from Sheep creek by 6,000 ft. flume and 450 ft. head from Wulf creek by 5,000 ft. flume. Six Peltons installed. Water rights recorded for 400 inches from both creeks.
Wulf creek....................	10	450	125	
Sheep creek :				
52 Development by Kootenay Belle gold mines.......... (Rogers Syndicate)	....	130	....	130 ft. head in about ½m.
Upper Sheep creek :				
52 Development by Mother Lode Sheep Creek Mining Co......	....	660	300	4,500 ft. wood pipe up one fork ; 2,100 ft. wood pipe u other fork, and 7,000 ft. steel pipe. Pelton wheels, tw dams.
Fawn creek :				
(trib to Sheep creek)				
53 Nugget Gold Mines.........	5	1,300	150	1,300 ft. fall in 4,500 ft. rapids, head of rapids 1m. fro mouth.
Erie creek (North fork Salmon river) :				
54 Rapids 1m. above Erie.......	....	80*a*	....	30 ft. head in ¼m. above Erie ; balance in ¾m. rapids rocky banks.
54 Rapids 2½m. above Erie......	....	170*b*	....	170 ft. in 1½m. rapids ; rock banks 20 ft. high.
54 Rapids 3½m. above Erie......	....	90*c*	....	90 ft. in 1m. rapids ; rock and gravel banks.
54 Total in 3½m................	66	340	500	*a*, *b* and *c* combined give head of 340 ft. in 3½m.
Mining development..........	....	260	250	250 h.p. developed at certain seasons for Second Reli Mill mine ; flume 2m. long.[4]
Beaver creek (near Ymir) :				
Mining development..........	....	300	200	200 h.p. developed at certain seasons for Dundee mine

*See Description of Power Tables.

‡*Report of Water Rights Branch*, British Columbia, 1914, p. H18.

§*Report of Minister of Lands*, British Columbia, 1913, p. D412.

‖River runs in narrow rocky valley with a total fall of about 400 ft. in the 16m. in B. C., or 25 ft. per mile, most which is reported developable by dams. In first seven miles above mouth it rises 34 ft. per mile ; total rise 2 ft. There are not any distinct falls of over 10 ft. in height, but, in several places, lesser falls occur in close proximit The most favourable power sites are above indicated. The head varies with the stage of the river, the differen between high and low water being in places over 20 ft. (See page 205.)

[1]Watershed : Area in the United States 24,630 sq. m. In British Columbia 1,190 sq. m.

[2]This head would affect the level of the water at the international boundary.

[3]For profile see *Annual Report of the Minister of Lands*, British Columbia, for 1912, p. D139.

[4]*Water Resources Paper* No. 8, pp. 44 and 45.

QUESNEL RIVER

A.—Showing typical 'cut banks' and country below Forks.
B.—Typical stretch of river below Forks. Note recent slide.
C.—First rock cañon and power site. About twenty-one miles from mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
	*	*	*	
Ymir (Wild Horse) **creek**: (trib. Salmon)				
55 Fall and rapids near mouth	39	340	300	Fall of 30 ft.; head of 340 ft. in 2½m. above mouth. Rock and gravel banks at head of rapids. Head optional.
Mining plant	....	....	150	150 h.p. developed at certain seasons for Yankee Girl mine.‡
Beaver creek (trib. to Columbia near Sayward)				
56 First rapids	90	30*a*	50	30 ft rapids in ½m.; rock banks 15-20 ft high.
56 Second rapids	....	130*b*	250	130-140 ft. rapids in about 1½m. Low gravel banks; 2 ft. irrigation dam here.
56 Third rapids	....	90*c*	175	90 ft. rapid in about ½m.; rock banks.
56 Beaver Creek falls	....	64*d*	125	Falls at G.N.Ry. bridge; high rock banks and cañon.
56 Total head available in 3m	85	300	600	*a, b, c* and *d* might be combined to give 300 ft. head in 3m.
Violin creek (near Trail):				
57 Proposed development	Small	100	....	Sec. 29, tp. 8; 100 ft. head possible; storage in Violin lake.
KOOTENAY RIVER AND TRIBUTARIES, INCLUDING TRIBUTARIES TO KOOTENAY LAKE				
Kootenay river:				
58 Rapids near mouth	19,450§	30	20,000	29 ft. in 1st m. rapids; 14 ft. in 2nd m.; head in 2m. 43-48 ft Banks, low, rocky and narrow. Proximity of C.P.Ry. tracks might limit development.
59 Sand Cut rapids	19,400	17	10,000	17 ft. fall in ½ to ¾m.; sand and gravel banks wide apart; probably difficult to develop.
‖60 Stones Byres (Slocan Junction Upper & Lower Cañon falls and rapids)	....	80	50,000	Direct falls of 25 ft. and 11 ft., total head 80 ft. in 1½m. from bottom of Lower Bonnington falls to pool at Slocan Junction.
‖60 Lower Bonnington falls	....	34	22,000	34 ft. working head at plant No. 1, West Kootenay Power and Light Co.
‖60 Rapids between falls	....	10	6,500	10 ft. in ½m. rapids; rock banks.
‖60 Upper Bonnington falls	18,000	70	45,000	Partially developed by Nelson municipality and also by W. Kootenay Power and Light Co. Wing dams. (See pages 170 and 208.)
‖60 Upper Bonnington falls (Nelson Municipal Plant)	....	2	....	Head varies from 40-65 ft., average about 52 ft. Developed by wing dam. (See page 163.)
61 Cora Lynn falls	....	7–10	6,000	7 ft. fall in short distance; rock banks.
61 Beasley rapids	....	7–10	6,000	6 ft. fall in 600 ft.; narrow rock channel.
61 Taghum rapids	....	....	....	5 ft. fall in about 300 ft. rapids; gravel banks.
61 Granite rapids	17,950	17	10,000	11 ft. fall in 300 ft.; head of 17 ft. might be developed.
62 Dam site, 3m. below mouth of White river	1,900	25	1,500	Rock cañon about 600 ft. wide; banks about 200 ft. high; head optional.
63 Dam site about 37m. above Canalflat	1,050	15	450	River 150 ft. wide; east bank 170 ft. high; west bank 35 ft. high. Head depends on height of any proposed dam.
Slocan river:				
64 First rapid (1m. above mouth)	1,300	25	850	20 ft. head in 2,000 ft. rapid; high rocky banks on west side; rock and gravel on east; possible dam site.
64 Logging dam (3m. from mouth)	1,300	6	200	British Canadian Lumber Co.; 6 ft. dam has at times been washed out. Light gravel and sand banks.
65 Winlaw dam site (½m. south of Winlaw)	900	6	150	Rocky banks receding gently. Proximity of C.P.Ry. tracks might limit development.
Little Slocan river:				
66 First rapids and falls (Lower cañon)	....	100*a*	....	Fall 21 ft.; 73 ft. rapids, all in 800 ft.; high rocky banks; fall at head of cañon.
66 Rapids between cañons	....	120*b*	....	120 ft. in 1½m.; banks, gravel and sand.
66 Upper Cañon falls	....	95*c*	....	Two falls; 63 ft. in 150 ft. and 32 ft. direct fall; dam-site at head of upper falls; rocky banks gently receding.
66 Total in 2½m	160	315	1,200	*a, b* and *c* might be combined to give total head of 315 ft. Intake about 2½m. above First East fork.
First East fork:				
67 First rapids and logging dam (4m. above mouth)	100	25	75	Low gravel banks; dam 8 ft.; 20 ft. head in 3,000 ft. rapids.

*See Description of Power Tables.

‡*Water Resources Paper* No. 8, pp. 44 and 45.

§Area of watershed in British Columbia = 14,550 sq. m.

In Montana 3,825
In Idaho 1,075 } In United States = 4,900 "

Total area above mouth = 19,450 "

Note—The various heads available at or near Bonnington falls might be combined in different ways. The greatest head that could be developed would be about 200-220 ft. from above upper Bonnington falls to the pool at Slocan Junction, a distance of about 2m. (For profile see *Annual Report of Minister of Lands*, B.C. for 1912, page D137.)

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—Continued

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
		*	*	*	
	Lemon creek:				
68	First rapids (1½m. above mouth)	....	120a	....	120 ft. in 1m. rapid ; low gravel banks.
	Second rapids (2½m above mouth)	....	115b	....	115 ft. in 1m. ; rocky banks ; low dam possible.
	Rapids in cañon (5m above mouth)	....	230c	....	230 ft. in 1½m. ; rocky banks ; dam might be placed at head of cañon.
	Total in 4½m	58	465	600	a, b and c might be combined to give head of 465 ft. in 4½m.
	Gwillim creek:				
69	Cascades ½m. from mouth	30	110	75	110 ft. in 500 ft. rapid ; rocky banks.
	Springer creek:				
70	First rapids (1m. above mouth)	....	100a	....	100 ft. fall in 3,000 ft. rapids ; rocky banks at upper end
	First fall (Springer creek cañon)	....	35b	....	Direct fall, high rocky banks.
	Second rapids	....	28c	....	28 ft. in 600 ft., rocky banks.
	Second fall	....	19d	....	Direct fall, rocky banks.
	Third rapid	....	10e	....	10 ft. in 600 ft.
	Third fall	....	13f	....	Cascades in 50 ft.
	Total in 1½m	15	205	75	Dam might be placed at head of cañon to control head (including a to f) of 205 ft. in 1½m.
	Enterprise (Ten-mile) **creek**:				
71	Mining development	....	....	150	150 h.p. developed at certain seasons for Enterprise mine.
	Four-mile creek§ (near Silverton):				
72	Mining development (intake 2m. above mouth)	45	160	1,000	160 ft. head developed by short tunnel and ½m. ditch and flume ; 20-in. C.I. pipe ; 5-ft. Pelton wheels. Supplies power to Standard and Hewitt mine. About 1,000 h.p. developed at certain seasons.
	Granite creek: (trib. Four-mile creek)				
73	Mining development	....	....	500	24 x 24-in. flume, 3,900 ft. long ; steel penstock 1,500 ft. Several Pelton wheels. Van Roi mine obtains about 500 h.p. from this creek at certain seasons.‡
	Carpenter creek:				
74	New Denver lighting plant (intake 2m. above mouth)	60	84a	80‖	Timber dam 16 ft. high, developing head of 84 ft.
	Total in 2m	60	350	500	350 ft. head (including a) can be obtained in 2 miles.
	South fork Carpenter creek:				
75	Mining development	....	....	700	About 700 h.p. is obtained at certain seasons for the Ruth, Noble Five and Ivanhoe mines.‡
	Sandon creek:				
	White creek:				
	Miller creek:				
	Tributary creek:				
75	Mining developments	....	....	200	Over 200 h.p. is developed at certain seasons for the Wonderful and Slocan Star mines.‡
	Payne and Reciprocity creeks:				
75	Mining development	....	....	300	300 h.p. developed at certain seasons for Payne mine.‡
	Last Chance Slide creek:				
75	Mining development	....	....	50	50 h.p. developed at certain seasons for Last Chance mine.
	Weesandy (Sawmill) **creek**:				
76	Falls 500 ft. from mouth	25	20	15	Fall 20 ft. ; operates small saw-mill.
	Wilson creek:				
77	First rapid (1½m. above C.P.Ry. bridge)	260	80	570	80 ft. in 1½m. rapid. Dam possible at head of rapid ; rocky banks.
	Second rapid (5½m. above mouth)	230	100	625	95 ft. in 1½m. rapid ; rocky banks ; dam-site at head of rapid.
78	Wilson creek falls (½m. above 1st West fork)	....	100	450	100 ft. in 500 ft. of falls and rapids ; dam site 200 ft. above falls ; high rocky banks ; further head of 80-100 ft. in 1m. rapids below.
	East fork Wilson creek:				
	Mining development	....	....	150	150 h.p. developed at certain seasons for Monitor-Ajax mines.‡
	Second East fork:				
79	Rapids ½m. above mouth	....	130	75	130 ft. in ½m. rapid ; 10 ft. dam possible.
	Fitzstubbs creek (First West fork)				
80	Rapids 2½m. above mouth	120	70	200	70 ft. head in ½m. ; falls and rapids in cañon ; 10 ft. dam possible.

*See Description of Power Tables.

‡*Water Resources Paper* No. 8, pp. 44 and 45.

§See *Annual Report of the Minister of Mines*, British Columbia, 1911, p. 147.

‖H.p. of one unit installed. Operates about 12 hours per day.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

No.	Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
	Second West fork :	*	*	*	
81	Rapids 1m. above mouth	....	60	65	60 ft. head in ½m. ; rocky banks ; 10 ft. dam possible.
81	Rapids 3½m. above mouth	45	35	40	36 ft. head in 900 ft. rapid in cañon, possible 10-15 ft. dam at head of cañon.
	Cottonwood creek (near Nelson) :				
82	Fall and rapid in cañon	16	190	100	Old dam with pipeline, at head of rapids. Drop in box cañon 186 ft. in 550 ft. from top of old dam ; also 47 ft. in 2,100 ft. rapid below cañon.
	Give-out creek : (trib. to Cottonwood)				
82	Mining plant	....	....	20	Formerly used to operate 10-stamp mill.

TRIBUTARIES TO KOOTENAY LAKE

No.	Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
	Kokanie creek (trib. West arm) :				
83	Mining development	....	....	200	200 h.p. developed at certain seasons for Molly Gibson mine.‡
	Coffee creek (near Ainsworth) :				
84	Mining plant	39x	107	150	Plant operates air compressor. 580 h.p. developed at certain seasons.
	Cedar creek (near Ainsworth) :				
85	Mining plant	....	....	500	500 h.p. developed at certain seasons for No. 1, Highland, Maestro and Silver Hoard mines.‡
	Indian creek (near Riondel) :				
86	Mining plant	....	750	250	250 h.p. developed at certain seasons for Bluebell mines.‡
	Fletcher (Bjerkness) **creek :** (trib. to Kootenay lake)				
87	Mirror Lake Elec. Light Co.	4	150	25	150 ft. in 1,300 ft. rapids. Small development for supplying light, etc., to fruit-growing settlement; 100 miner's inches applied for ; 36 in. Pelton and 35 k.w. generator installed.
	Kaslo creek :				
88	Kaslo power plant (intake 1½m. above mouth)	165	42	250	42 ft. fall in 1,400 ft. rapids. Concrete dam 10 ft. high ; 42 in. wood-stave flume. Record for 2,000 miner's inches. 250 h.p. installed.
	Twelve-mile creek (trib. Kaslo) :				
89	Mining plant	....	....	200	200 h.p. developed at certain seasons for Utica mine.‡
	Whitewater creek (trib. Kaslo) :				
89	Mining plant	....	....	200	200 h.p. developed at certain seasons for Whitewater mine.‡
	Campbell creek :				
90	Rapids in rock cañon (1½m. above mouth)	46	110	[illegible]	114 ft. in 1½m. cañon, 30 ft. wide, precipitous walls 50 ft. high.
	Fry river :				
91	First rapid (¼m. from lake)	....	70*a*	....	70 ft. in ¼m. rapid ; rocky banks.
91	First fall (½m. from lake)	....	11*b*	....	Fall 10 ft. ; rocky banks and lower end of cañon.
91	Second rapid (above First fall)	....	37*c*	....	37 ft. fall in 500 ft., rocky cañon.
91	Second fall (above Second rapid)	....	25*d*	....	Fall in rocky cañon.
91	Third rapid (¾m. from lake)	....	69*e*	....	70 ft. in 800 ft. rapid ; end of rocky cañon.
91	Total in ¾m.	190	212*k*	1,750	Dam could be placed at head of cañon to secure total head of 212 ft. (including *a* to *e*) in about ¾m.
91	Rapids, head 1m. from lak		74*f*	....	74 ft. in ½m. rapids ; rocky banks.
91	Rapids, 2m. from lake		50*g*	....	250 ft. in about 1m. ; rocky banks.
91	Rapids, 3m. from lake		50*h*	....	150 ft. in about 1m.; high gravel and clay banks on north, sand and gravel on south.
91	Rapids, 3¾m. from lake		20*i*	....	120 ft. in ¾m. rapids ; loose rock and gravel banks ; big mud slide.
91	Total head in 3¾m.		800	6,500	Total possible head in 3¾m. (including *k*) about 800 ft.
	Davis creek :				
92	Falls in rock cañon (¾m. above mouth)	15	175	100	20 ft. direct fall, with ¾m. rapids, gives 175 ft. head from top of falls to creek mouth. Rocky cañon, precipitous walls.
	Hamill creek :				
93	Rapids in rock cañon (5½m. above mouth)	90	250–300	125	310 ft. in 2¼m. rapids ; cañon walls of limestone, 40 ft. wide and 60 ft. sheer.
	Cooper creek :				
94	Old dam at foot of cañon (1m. above mouth)	115	13	50	Old dam, formerly used for placer mining.
94	Fall in cañon (1½m. above mouth)	110	85	350	Box rock cañon, 40-80 ft. deep, fall 15 ft. with possible head of 85 ft. in ½m. Glacial stream.
	Lardeau river :				
95	Dam site (1½m. south of Poplar)	585	....	....	Small head might be created by dam, probably flood land and C.P.Ry. track.

* See Description of Power Tables.
‡ *Water Resources Paper* No. 8, pp. 44 and 45.
x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Tenderfoot creek :				
96 Cañon ¾m. above mouth	20	20	15	20 ft. fall in about 600 ft. rapid ; rocky cañon.
Abramson creek :				
97 Rapid 2m. above mouth	13	60	30	60 ft. fall in 1,000 ft. rapid ; rocky banks ; 10 ft. dam possible.
Glacier creek : (trib. to Trout lake)				
98 McPherson dam (about 1m. from Trout Lake city)	15	325	100	325 ft. head in 2,700 ft. flume. Timber dam of 4 ft. ; used for lighting Trout Lake City, and running small shingle mill ; 50 h.p. installed, record for 1 sec.-ft. Power plant near mouth
98 Possible total head	....	1,000	250	
Lardeau creek :				
99 First rapids (1m. above mouth)	....	140*a*	....	140 ft. head in 1m. rapid ; dam about 15 ft. high at head ; high rocky banks.
99 Second rapids (1½m. above mouth)	....	70*b*	....	70 ft. head in ½m. ; high rocky banks.
99 Third rapids (2¾m. above mouth)	....	110*c*	....	110 ft. in ¾m. rapids ; high rocky banks.
99 Fourth rapids (Head at Ferguson)	....	200*d*	....	200 ft. in 1¾m. ; rocky banks.
99 Total head in 4½m	110	520	2,000	Combining *a* to *d* a total head of 520 ft. in 4½m. might be obtained.
100 South Fork rapids (Ferguson to Five-mile mine)	....	160	350	160 ft. fall in 1½m. rapid ; rocky and gravel banks.
100 Five-mile plant on South fork (about 2m. from forks)	60	130	275	130 ft. in 3,800 ft. flume ; timber dam 4 ft. high ; record 1,200 miner's inches ; 120 k.w. generator.‡
101 Ten-mile plant on South fork (at Ten-mile)	40	98	150	30 ft. fall ; total head 94 ft. in 4,000 ft. flume. Timber dam 4 ft. at head of fall ; 2 Pelton wheels driving air compressor.
Ferguson creek (North fork) :				
102 Cañon 1m. from confluence	46	60	100	60 ft. in 800 ft. rapid ; high rocky banks.
Trout creek : (trib. to Trout lake)				
103 Falls about 3½m. from mouth	20	40	30	Undeveloped creek ; flat and marshy up to falls of 40 ft.
Lower Duncan river	1,845§	....	....	Said to have no power sites.
Duncan river	765	....	....	Said to have no power sites in lower reaches.
Glacier creek : (trib. to Duncan river)				
104 Fall and rapid (between bridge and 3m. up stream)	80	450	1,700	110 ft. fall in 500 ft. rapid ; total 450 ft. in 2m. cañon. First mile through bottom land ; above cañon, valley wider with easier grade. Glacial stream.
Howser creek :				
105 Rapids in first 1½m. of cañon	180	290	2,350	290 ft. in 1½m. rapids ; above cañon creek widens. Glacial stream.
Reno creek (or East river) :				
106 Rapids in cañon, 4m. long	25	200 per m.	220	Cañon ½m. from mouth ; descent about 200 ft. per mile.
Hall creek :				
107 Rapids in cañon below bridge	15	500	275	150 ft. fall in ½m. ; fall 500 ft. in 1½m. Stream on bed rock. Glacial stream, more head higher up.
Midge creek :				
108 Rapids 1m. above mouth	100	50	180	50 ft. head in 700 ft. rapids and 3 small falls ; rocky banks, dam-site at head of falls. More head in next mile upstream.
Cultus creek :				
109 Cultus Creek falls (3½m. from mouth)	65	135	320	Fall of 35 ft. ; 100 ft. in ½m. rapid below. Steep granite banks.

TRIBUTARIES TO KOOTENAY RIVER ABOVE KOOTENAY LAKE

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Goat river :				
110 Cañon near Erickson	420	100	1,150	Cañon said to afford good power site ; head optional.‖
111 Cañon about 2m. below Cameron creek	....	15*a*	60	*a* and *b* might be combined by 1½m. of flume, and additional head obtained.
111 Cañon about ¾m. below Cameron creek	....	15*b*	60	
111 Rapids ½m. above Cameron creek	....	100	200	Succession of small rapids ; 100 ft. head might be obtained by dam and pipe line ; bed rises rapidly, giving succession of small powers for distance of 2 miles.

*See Description of Power Tables.
‡See *Report of Geological Survey of Canada*, Vol. 15, p. AA68.
§Drainage area north of Kootenay lake.
‖*Water Resources Paper* No. 14, p. 386.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

No.	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Moyie river :	*	*	*	
112	Logging dam near Ryan....	380	8	50	East Kootenay Lumber Co., 8 ft. dam ; low banks
112	Logging dam........ (near Irishman creek)	300	8	50	East Kootenay Lumber Co., 8 ft dam ; low banks
113	Logging dam........ (1½m. below Aldridge)	280	8	40	East Kootenay Lumber Co., 8 ft. dam ; low banks.
114	Suggested development..... (near Nigger Creek flat)	....	280	100	Held by Upper Moyie Electric Co. High rocky banks ; possible dam 30 ft., might be raised to 70 ft. ; pipe line about 1m. would give head of 280 ft
114	Suggested development.... (near Old China Bar)	....	....	....	Old China Bar possibility included in Nigger Creek site.
	Phillipps creek :				
115	Cascade........ (1½m. east of Roosville)...	20	400	100	Drop of 325 .. b cascade ; 55 ft. fall in ½m. rapids. Possible 20 ft. dam at head in rock cañon.
	Linklater creek...............	60x	....	....	Said to have no power possibilities used for irrigation.
	Gold creek :				
116	Dam site 3m. above mouth..	345	35	100	Rocky banks 40-50 ft. apart, 200 ft. high; possible dam-site, also small reservoir possibility.
	Elk river :				
117	Phillipps Bridge dam-site.... (6m. south of Elko)	1,800	50	3,500	Rock cañon, banks over 100 ft. high ; head of 30 ft. in 3,000 ft. of rapids and by possible dam 25-35 ft.
118	Dam-site south end of cañon. (3m. south of Elko)	1,480	80	4,000	Fall of about 60 ft. in ½m. rapid ; head might be increased 20-40 ft. by a dam.
118	Elk River canon— First fall	....	24*a*	....	Direct fall ; rock cañon for ½m. above ; banks 100 ft. high.
118	First rapid........	....	73*b*	....	Rock cañon 70 ft. in about 1,500 ft. rapids between falls.
118	Second fall........	....	13*c*	....	Irregular falls divided by rock island.
118	Second rapid........	....	19*d*	....	Cañon ends at head of rapid ; 19 ft. fall in about 800 ft. rapids.
118	Power site........ (upper pool to lower pool)	1,480	170	10,000	This 170 ft. takes in whole cañon including *a*, *b*, *c* and *d*.
119	Dam-site at highway bridge. (1m. above Michel creek)	920	10–15	500	Rocky banks 20-30 ft. high. Information indefinite.
120	Dam-site below Bingay creek.	360	15–20	250	High gravel banks on west ; banks on east 15-25 ft. high ; fall of about 20 ft. in ½m.
121	Dam-site at First Elk lake...	....	10	....	Head might be created by dam at outlet of lake ; rocky banks in places, gently receding.
121	Dam-site at Second Elk lake.	....	40–50	....	Fall of about 50 ft. from 2nd lake to 1st lake ; 20 ft. dam possible at outlet of lake. Lake reported 2 sq. m. area ; glacier at west end.
	Wigwam river :				
[illegible]	Dam-site 1m. from mouth..	310	65	350	60 ft. fall in 1m. ; high rock and gravel banks on south and rock banks 60 ft. high on north. Possible 20 ft. dam.
[illegible]	Rapids about 4m. from mouth	300	100	600	100 ft. fall in about 1½m. Gravel and rock banks, high and sheer on south side. Irrigation dam proposed here.
	Lodgepole creek :				
123	Rapids 2m. above mouth....	55	50–100	80–100	Good banks ; fall of about 100 ft. in 1m.
	Lizard creek :				
124	Rapids 1m. from mouth.....	20	80	30–50	80 ft. fall in 1m. ; rocky banks 150 ft. apart, 40 ft. high. Town of West Fernie claims 900 miner's inches.
	Fairy c[illegible] :				
125	Fernie water supply........	....	250	50–75	Concrete dam 8 ft. high. Head from crest of dam to river mouth 250 ft.
	Michel creek :				
126	Dam-site 1½m. above Michel	220	80	65[illegible]	[illegible] dam possible ; high rocky banks on south side ; low [illegible]avel banks on north side ; 80 ft. rapids in about 1½m.
126	South branch........	150x	30–50	25[illegible]	[illegible]re are dam-sites on this fork ; fall about 50-60 ft. per mile.
126	East fork 2m. west of Crows-nest........	58	80	150–200	70 ft. fall in 1m. might be increased 20-30 ft. by dam ; narrow rocky valley, high cliffs. Several dam-sites between here and South fork below. Care not to flood railway tracks.
	Cummings (Wilson) **creek** :				
127	Dam-site 1m. from mouth....	62	60	100–150	Low dam might be erected ; fall about 65 ft. per m. ; other sites further upstream.
	Fording river :				
128	Josephine falls........ (8m. from mouth)	....	30*a*	....	Falls of 30 ft. in several breaks ; small rapid below ; shale banks about 60 ft. high.
128	Cañon above falls........	....	50*b*	....	Rocky cañon and high banks ; 50 ft. fall in ½m. rapids.
128	Total head in ½m........	175	100	600	With d[illegible],and combining *a* and *b*, head of 100 ft. possible.
	Big (Porcupine) **creek** :				
129	Falls 6m. above mouth......	60	60	100–150	Rocky cañon below falls ; dam might be built above falls and more head obtained in rapids in cañon.

* See Description of Power Tables.
‡ Several sites where 100-250 h.p. might be developed.
x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—Continued

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Aldridge creek:				
130 Rapid 1m. above mouth....	20	70	50–100	Head of 60 ft. in ½m.; rocky banks 35 ft. high; rapid stream; other sites reported above.
Bloasdell creek:				
131 Rapid 1m. above mouth.....	45	75 per m.	150–200	Said to be several sites for small developments. Total head indefinite, estimated over 75 ft. per m.
Sand creek:				
132 Daly dam 2m. above C.P.Ry. bridge..................	49	25	25–50	Abandoned dam of concrete and timber 21 ft. high. From dam to bridge fall of about 100 ft. in 2m.
Falls in rock cañon ...... (4m. above C.P.Ry bridge)	47	110	100–150	About 85 ft. head in series of falls in rock cañon in 600 ft.; 50 ft. head in ½m. of rapids above. Below cañon stream falls 70-90 ft. per m.: dam might be built above falls head optional.
Old dam 6m. above C.P.Ry bridge	43	10	....	Old log dam in bad repair.
Bull river:				
133 Falls in cañon............. (3m. above mouth)	...	273a	6,100	Fall of 90 ft.: head created by dam in cañon, diverts water into flume 9,200 ft. long; gives 273 ft. head.
Rapids in cañon.......... (4m. above mouth)	....	40b	900	a and b might be combined to give head of 310 ft. Banks, slate rock.
Rapids 5½m. above mouth..	625	150	3,500	Dam and flume would give head of about 150 ft. in 1½m.
Iron creek:				
134 Dam site ½m. below South fork.....................	20	100	30–50	Dam-site for head 20-25 ft. Portion of creek falls 70 ft. per mile.
Dibble creek:				
135 Rapid 2m above mouth.....	....	20	10	Fall of 8 ft. in 200 ft. rapid; proposed dam 20 ft. high; rocky banks.
Van creek:				
136 Rapid and cañon ½m. from mouth..................	....	20	10–15	10 ft fall in 1,500 ft. rapid; possible dam 10 ft. high; cañon walls of slate-shale.
Little Bull river:				
137 Fall and rapid 2m. above mouth..................	15	90	10–15	Fall of 26 ft.; 11 ft in 250 ft rapid below, and 55 ft. in 900 ft. rapid above. Small reservoir possible; earth banks with rock outcrop in places.
Wild Horse creek:				
138 Rapids 4m. from Fort Steele.	65	100	15–20	Creek a succession of rapids: fall about 100 ft. per mile.
St. Mary river:				
139 Dam site 2m. above Mission	850	20	600	Rocky banks 25 ft. high; possible dam 10-15 ft. high.
140 Wycliffe dam-site.......... (1m. above Wycliffe)	825	30	900	Rocky banks 50-60 ft high; narrow gorge 600 ft. above bridge.
141 Marysville dam-site .... (1½m. above Marysville)	655	50	1,200	High banks, boulders, sand, gravel, and clay; proposed dam of 12 ft.; balance of head in rapid.
142 St. Mary Lake dam-site..... (½m. east of lake)	500	20	400	20 ft. head in ½m. rapid; gravel and rock banks 30 ft. high.
Perry creek:				
143 Lower cañon 3m from mouth	78	10	20	Low rocky cañon.
At brickyard.............. (5m from mouth)	67	15	25	15 ft. fall in 1,200 ft., rock bluff 35 ft. wide. Developed by overshot waterwheel 12 ft. diam. by 6 ft. face.
Dam site in narrow ravine... (1½m. above brickyard)	62	40	55	Head could be developed by dam in ravine.
Perry Creek falls.... .... (2½m. above brickyard)	56	140	180	Heavy rock; in three pitches; possible small reservoir a little above falls.
Mark creek:				
144 First rapid................	54	98a	....	98 ft. fall in about ½m. rapid.
First fall and rapid above.... (Fort Steele Mining and Smelting Co.)	....	80b	....	40 ft. fall, also 40 ft. head in 500-1,000 ft. rapid above. Developed by Fort Steele Mining and Smelting Co.
Combining above..........	54	180	250	a and b might be combined for head of 180-200 ft.
Kimberly power plant...... (Consolidated Mining and Smelting Co.)	....	180	150–200‡	Head of 180 ft. in 4,000 ft. pipe line; power developed by three 6 ft. Pelton wheels.
Fall 3m. above Kimberly....	27	75	50	Direct fall of 75 ft.
Matthew creek:				
145 Rapid near mouth..........	40	90	80–100	90 ft. head in [illegible] rapid; gravel banks; low dam might be placed about ½m. above mouth.
Meacham (Whitefish) **creek:**				
146 Fall, 1m. from mouth.......	47	240	350	Direct fall 50 ft.; total descent from 1m. above fall to foot of rapids below, 240 ft. Said to be other sites further up creek.
Lewis creek:				
147 Hansen dam...............	...	160	50	100 ft. developed for electric light plant and sawmill: 36 in. Pelton wheel

*See Description of Power Tables.
‡Considerably more power is actually developed at certain seasons.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
		*	*	*	
	Sheep creek :				
148	Rapids 19m. above mouth...	110	10	30	Bed of stream and banks gravelly.
	Diorite creek (trib. Sheep creek) :	....	....	...	Said to have no power possibilities.
	Skookumchuck river :				
149	Dam site near road bridge.. (below Sandown creek)	350	25	200	Bank rocky formation, about 40 ft. high ; fall about 40 ft. to mile.
149	Long rapid............ (3m above road bridge)	350	50	400	Direct fall 15 ft. ; about 50-60 ft. obtainable in ½m., banks in places high and rocky
	Findlay creek :				
150	First fall and rapids below... (6m. above mouth)	330	[illegible]	2,500	Fall 10 ft. ; 300 ft. fall in 3m. rapids below ; at fall rocky banks 20-40 ft. high. Drainage area includes large group of glaciers.‡
150	Second fall and cañon rapid.. (10m. above mouth)	315	100	850	Fall 20 ft. in 400 ft. rapids ; rock cañon 30-50 ft. wide, 40 to 50 ft. high. Dam above cañon, with ½m. pipe-line might develop 100 ft. head.
151	Rapid just above mouth of South fork..............	[illegible]	25	180	Continuation of rapids about 50 ft. per m. ; banks sometimes high and rocky.
	White river :				
152	Rapid in cañon............ (1m. above mouth)	400	[illegible]	350	Head in rapids 30 ft. per m. ; said to be no falls for 45m. above mouth.
	Palliser river :				
153	Cañon ½m. above mouth....	270	40	350	Dam might be built here ; banks shaly limestone ; cañon 130 ft. wide
153	Rapids and falls 3m. above mouth..................	....	180	1,500	40 ft. in falls total fall 175 ft. in 4,500 ft. ; deep cañon below falls
154	Devils Hole falls........... (8m. above mouth)	215	75	500	30 ft. fall ; total fall, 75 ft. in ¼m.
155	Cañon 19m. above mouth...	100	105	300	52 ft. falls ; total descent 104 ft. in 2,000 ft. ; narrow cañon with perpendicular rock walls 20 ft. apart, for 1,500 ft. below falls.
	Cross river....................	300x	....	....	Said to have no power sites in lower reaches.

TRIBUTARIES TO THE ARROW LAKES

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Eagle creek (near Edgewood) :				
156	Rapids about 2m. from mouth.	....	260a	....	260 ft. in about 2m. rapids ; rocky banks.
156	Rapids about 3½m. from mouth	....	110b	....	110 ft. in about ½m. ; rocky cañon, 175 ft wide.
156	Rapids about 3¾m. from mouth..................	....	125c	....	125 ft. in 1m. ; rocky cañon 200 ft. wide.
156	Total in about 4m..........	40	500	450	Total head, about 500 ft. in less than 4m. ; includes a, b and c.
	Inonoaklin creek :				
157	Rapid below fall...........	....	40a	....	40 ft. in 1m. rocky cañon at upper end.
157	Inonoaklin fall (near mouth).	....	32b	....	Direct fall in rocky cañon.
157	Second rapid, above fall.....	....	8c	....	8 ft. in 200 ft., rocky cañon.
157	Second fall (at head of cañon)	....	10d	....	Direct fall ; low rock banks ; old logging dam formerly here.
157	Total head in 1½m..........	150	90	300	Total head 90-100 ft. in about 1½m. above mouth includes a, b, c and d.
	Arrowpark (Mosquito) **creek :**				
158	Rapids in 1½m. above mouth	120	20	50	20 ft. fall in 1½m. Clay and sand banks below gravel higher up.
	Kuskanax creek :				
159	Cañon 1m. from mouth.....	120	40	130	Cañon 100 ft. long, 30 ft. wide, 40-50 ft. deep.§
160	Falls 8m above mouth...... (800 ft. below Nakusp Hot Springs)	105	35a	100	25-30 ft. fall ; natural dam of solid rock ; rocky banks.
160	Rapids at Hot Springs......	105	30b	85	20 ft. in 300 ft. rapid ; rock banks and bottom. For additional head, a and b might be combined.
	Fosthall creek :				
161	First fall..................	....	70a	....	Short cañon, walls 50ft. high, solid rock.
161	Second fall................	....	25b	....	For 2nd, 3rd, and 4th falls, walls of cañon are 25-50 ft. high at head and 60-125 ft. high at foot, rising in series of benches. Above 4th fall banks are 15-20 ft. high, gravel with bed rock in places. Old dam at head of 4th fall and log chute to foot.
161	Third fall..................	....	80c	....	
161	Fourth fall.................	....	135d	....	
161	Total head in ½m...........	100	480	1,300	Total fall, including, a, b, c and d, 480 ft. in ½m. from crest of dam to below falls.

*See Description of Power Tables.

‡See *Annual Report, Minister of Lands*, British Columbia, for 1913, p. D181.

§See *Water Resources Paper* No. 14, p. 392.

x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. I—*Continued*

Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
	*	*	*	
Pingston creek :				
162 First rapids (Gibbons saw mill, ½m. from mouth to dam)	....	72a	....	75 ft. head in 1,800 ft. rapids ; crest of dam to mouth creek 115 ft. Saw-mill working head 72 ft., by flum and 2 pipes 410 ft. long. Two turbines of 250 and h.p.
Second rapids	....	60b	....	60 ft. in 500 ft.; creek bottom 20-25 ft. wide, high, pe pendicular, rock walls.
Third rapids	....	70c	....	70 ft. in 250 ft. rapids ; above, creek flows in deep cañ for 4m. to forks and additional head may be obtained
Total in 1m. above mouth	105	350	1,000	Head in 1m. from mouth 350ft. Includes *a*, *b* and *c*.
Leon creek :				
163 First falls (½m. above mouth)	....	100a	....	100 ft. fall in 400 ft.; possible dam-site 250 ft. above falls.
Second falls (1½m. above mouth)	....	40b	....	40 ft. fall in 20ft.; possible dam-site at head of 2nd fal
Total head in 1½m.	95	450	1,200	450 ft. head obtained in 1½m.; includes *a* and *b*.
Beaton (Salmon) **creek :** (Northeast arm Arrow lake)				
164 Rapid near mouth	40	1,100	1,120	1,000 ft. in about 3m.; series of rapids. Storage in Ar strong and Staubert lakes.
Incomappleux (Fish) **river :**				
165 Rapid 2½m. from mouth	455	150	2,500	100 ft. fall in cañon 3,000 ft. long ; width 60-100 ft bottom ; walls broken rock. Dam site here.
Pool creek :				
166 Eva Gold Mine dam	28	400	175	Operating stamp mill ; 325 h.p. installed ; record inches ; greater head possible.
Great Northern Mines Co.	....	250–300	230	Intake nearer mouth than Eva Mines intake, 200 h full capacity.
Menhinick creek :				
167 Goldfinch Mining Co.	....	100	20	Plant near mouth.

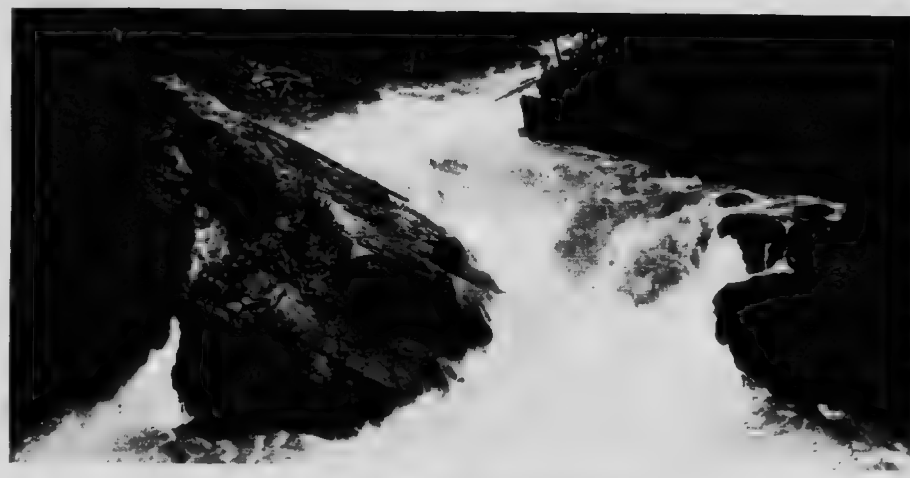
TRIBUTARIES TO COLUMBIA—RAILWAY BELT WEST

Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
Akolkolex river (Isaac creek) :				
†168 Cañon and falls 2m. from mouth	100	400	5,000‡	Falls 335 ft. in 150 ft.; possible total 400 ft. in 450 Box cañon 35 ft. wide, 450 ft. long, banks 30-40 ft. hi Other sites on upper reaches.
Illecillewaet river :				
†169 Revelstoke power plant 1½m. east of city	475	72	2,300	72 ft. head developed by concrete dam 56 ft. high and 6 ft. diameter wood-stave pipes. Dam forms pond of 10 acres. One 900 h.p. and one 1,400 h.p. installed. Standby gas engine.
†170 Cañon just below confluence of North Fork	250	50	600	30 ft. fall in 600 ft. rapids in cañon ; walls rock, so what broken, 20-40 ft. high, width 30 ft.
†171 Albert Cañon gorge	130	275	1,600	275 ft. in 2½m. ; rapids in box cañon, width 20-50 height 100-300 ft. Fluming here would be diffi and costly.
†172 Glacier House power plant	....	60	200	60 ft. in 800 ft. rapid and fall ; 12 hour power May October. Concrete dam 15 ft. high, 10 ft. long ; line, 800 ft. of 18 in. C.I.; two 25 k.w. generators.
Jordan river (trib. to Columbia at Revelstoke):				
†173 Lower cañon	....	55a	....	55 ft. in 2,000 ft. rapids ; head of cañon 1,500 ft. be falls ; rocky cañon, walls about 100 ft. high.
Jordan falls	..	22b	....	Direct fall 22 ft.
Upper cañon	...	80c	....	80 ft. in 1,500 ft. rapids ; rocky cañon ; banks 40-5 high.
Total in about 1m.	95	155	400	Head of about 155 ft. possible, combining *a*, *b* and *c*.
Eight-mile creek (trib. to Columbia, 8m. above Revelstoke):				
†174 Falls and rapids	12	200	75	80 ft. direct falls, and 110 ft. in 1,500 ft. rapids ; can be increased.

TRIBUTARIES TO COLUMBIA, NORTH OF RAILWAY BELT

Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
Carnes creek :§				
175 Cañon 1m. from mouth	80	....	....	Cañon 2½m. long ; no direct fall. Small lake, 10m. Carnes creek is in Railway Belt except 1st mile mouth.
Salmon creek :				
176 Falls ½m. from mouth	Small	....	....	Has good fall near mouth, then low grade into Ry. B
Seymour creek :				
177 Rapids and falls near mouth	....	....	....	Good fall in rapids near mouth ; storage in lake above falls.

* See Description of Power Tables.
†Power sites on streams within the confines of Railway Belt.
‡See records of stream flow.
§Most of watershed lies within confines of Railway Belt.



QUESNEL RIVER—FALL ON NORTH FORK
About two miles below Cariboo lake. Attempt to construct fish ladder seen on left.

BRIDGE RIVER—VALLEY ABOVE CAÑON
Looking downstream towards site of proposed dam, as indicated by white line.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Downie creek:				
178 Box cañons on forks	275x	....	....	Low grade for 13m. to forks; on both branches, box cañons with falls; above cañon, main stream has low grade for 10-12m.; glacial fed.
Forty-nine creek:				
179 Falls	....	....	....	Small fall at mouth, then low grade for 2 or 3m., then 150 ft. falls.
Fissure creek:				
180 Cañon near mouth	....	....	....	Short cañon near mouth; grade above reported gentle for most of length.
Gaffney (Smith) **creek:**				
181 Rapids near mouth	....	480	650	480 ft. fall in 2½m.; banks sloping; above rapids, low grade and swampy; good site for storage dam at head of rapids; partially developed for gold-washing by Smith Creek Mining and Development Co.
181 Fall	....	150	150	Said to be direct fall of 150 ft. in upper waters.
One-mile creek:				
182 Rapids near mouth	Small	....	....	Rapid fall near mouth, then lower grade above.
Gold stream:				
183 Rapid and falls (in cañon near mouth)	380	280	4,000	Cañon for 2m. from mouth; direct falls of 30 and 60 ft. and 190 ft. descent in 9,200 ft. rapids; banks chiefly soft limestone; high rock bluffs at falls. Above cañon, low grade for several miles. Falls reported on upper waters.
Sibley (Soda) **creek**	Small	....	....	Said to have low grade with numerous beaver swamps.
Davis creek:				
184 Rapids	Small	....	....	Small, rapid, mountain stream.
Gordon (Holden) **creek**	Small	....	....	No power sites for 7m. above mouth; gentle slope, about 50 ft. per mile.
Horne creek	....	....	....	Cañon near mouth, but very low grade and small power possibilities.
Scrip (Flat) **creek**	....	....	....	Low grade and many beaver swamps; small power possibilities, if any.
Bigmouth creek:				
185 Cañons and falls on forks	....	....	....	Reported low grade for 8 or 9m. to forks. Some small falls on North fork and some lakes. On main stream cañons and falls above forks.
Maloney creek:				
186 Falls, 2 and 5m. above mouth	....	....	....	Series of small falls about 2m. from mouth, then low grade for 2 to 3m., then more falls.
Mica creek:				
187 Falls on forks	....	....	....	Very little cañon or falls below forks. Some falls on forks, but streams small.
Soard creek:				
188 Falls and rapids in deep cañon	....	195	250‡	Direct fall 45 ft. and 150 ft. descent in 3,280 ft. rapids; deep box cañon, walls several hundred feet high.
Nagle creek:				
189 Rapid in cañon	....	40	75‡	35-40 ft. in short cañon near mouth; low grade above.
Canoe river	1,500x	....	....	Said to have no economical power possibilities on lower reaches.
Harvey creek (trib. Canoe river):				
190 Rapids near mouth	....	350	1,000	350 ft. fall in 7,560 ft. above mouth; grade flatter above; head optional; banks steep and rocky; heavily timbered, cañon in places.
Boulder creek (trib. Canoe river):				
191 Rapids near mouth	....	340	1,500	340 ft. fall in 5,600 ft. above mouth; head optional; banks steep and rocky, heavily timbered.
Cache creek (trib. Canoe river):				
192 Cañon, ½m. above Golden trail crossing	....	80	150	60-80 ft. head in 300 ft. rapids in cañon.§
Molson creek	....	....	....	No power sites known; extensive swamps in lower reaches.
Wood river:				
193 Rapid in cañon (4m. above mouth)	420	275	3,000	Cañon 1½m. long; 275 ft. fall in 1½m. rapids. Storage possible on extensive flat above cañon; dam-site at head. Cañon reported 7 or 8m. further up stream.
Yellow creek:				
194 Falls, 9m. above mouth	Small	1,000	500	Direct fall of 730 ft.; fall 500 ft. per mile for 4m. below; small stream; head optional.
Goose Grass creek:				
195 Fall and rapids near mouth	Small	800	300	44 ft. direct fall; 255 ft. fall in 3,850 ft. Sloping banks, cañons in places, heavy timber, head optional; about 1,000 ft. obtainable in 2m.

*See Description of Power Tables.
‡Insufficient data for estimate.
§*Report of Minister of Lands*, British Columbia, 1913, page D444.
x Drainage area above mouth.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
	*	*	*	
Cummins creek :				
196 Rapids near mouth	140	420	1,500	420 ft. fall in 2½m. rapids ; possible storage in extensi[ve] beaver swamp higher up.
Middle river (to Kinbasket lake) :				
197 Cañon and falls (1m. from mouth)	....	....	....	Low grade for 1m. above mouth ; then cañon with fall[s] above cañon, large gravel flat.
Glacier creek (trib. Kinbasket lake)	Small	....	....	Small glacial stream 3m. long ; steep grade.
Sullivan river : (trib. Kinbasket lake)				
198 Cañon 4m. above mouth	....	....	....	Reported low grade for 4m. ; then cañon and falls fo[r] or 3m. ; gravel flats above.
Windy river	....	....	....	Short stream with considerable fall.

TRIBUTARIES OF COLUMBIA—RAILWAY BELT, EAST

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
Gold river (East) :				
†199 Rapids, 7m. above mouth	235x	....	....	Said to have low grade for 7m. from mouth ; then ri[ses] rapidly to source in glaciers.
Bush river :				
200 Cañons at headwaters	640x	....	....	Nearly level for 10m. from mouth and very low grade [for] further 8-10m. ; cañons above.
Beaver river :				
†201 Natural Arch rapids (1½m. from Beavermouth)	440	80	1,600	80 ft. fall in 3,000 ft. rapids ; rapid, mountain strea[m] rocky banks 20-50 ft. high. Development limited [by] proximity of C.P.Ry.
Blaeberry river :‡				
†202 Blaeberry fall and rapids (8m. above mouth)	300	170	2,000	Falls at head of cañon, 20 ft. ; 135 ft. in 2m. rapid[s] possible small pondage ; steep rocky banks 30-50 [ft.] high ; river 15-50 ft. wide ; head optional.
Kicking Horse river :				
†203 Cañon near mouth	700	300§	5,000	River flows in deep cañon with grade of about 60 to 70 [ft.] per m. for 10 miles.‖
†204 Wapta falls (3m. from Leanchoil)	600	100	2,200	84 ft. fall ; banks 100-200 ft. high ; rocky bed ; dam-[site] above falls with tunnel 600 ft. long. Power site in val[ley] of small creek below falls. Anchor ice to be contend[ed] with.
†205 Kicking Horse cañon (2½m. west of Field)	135	80	500	70 ft. in 600 ft. cascades ; box cañon 600 ft. long, wi[de] 30 ft. at water level, banks 30-100 ft. high. Sm[all] storage in Sherbrooke and Wapta lakes. Scenic bea[uty] of Natural bridge must be preserved.
†206 Yoho river to Wapta lake	30y	1,000	1,300	1,000 ft. fall in 3m. of which 350 ft. occurs in 1m. rapi[ds] 400 ft. in ½m. ; 100 ft. in ½m. ; steep rocky ban[ks] Storage in Wapta lake limited by C.P.Ry. tra[ck] Possible pipe line on old C.P.Ry. grade.
Ottertail river :				
†207 Rapids	95x	250	900	300 ft. fall in 4m. ; no particular fall or rapids, stre[am] falls 80-100 ft. per m. ; rocky banks, heavily timbe[red]
Cathedral (Thompson) **creek :** (2m. east of Field)				
†208 Monarch mine (Mount Stephen Mining Syndicate)	5x	280	50	Falls 280 ft. in 1,700 ft. rapids. Small development [giv]ing 100 h.p. for 4 months in summer. Flow very sm[all] in winter. 4 ft. Pelton wheel ; steam auxiliary.
Yoho river :				
†209 { Rapids at mouth	60	100	250	Falls 80 ft. in 900 ft. ; dam-site 300 yards from mou[th] above dam-site flat open country for 2m. Very li[ttle] storage. More head by fluming down Kicking H[orse] valley.
†209 { Cañon 2½m. from mouth (5m. long)	56	400	900	410 ft. rapids in 5m. Power site on east bank at foo[t of] cañon, dam-site at head ; rock cañon 300 ft. deep [..] ft. wide at bottom.
Sherbrooke creek : (½m. below Wapta lake)				
†210 Falls and rapids in cañon	16x	450	350	450 ft. fall in ½m. rapids ; series of falls and rapid[s] cañon of broken rock ; storage in Sherbrooke l[ake]. Small power possible at little expense.
† Takakaw falls (trib. to Yoho river)	....	....	....	Direct falls of 1,250 ft. Scenic beauty forbids po[wer] development.
† Twin falls (trib. to Yoho river)	....	....	....	

*See Description of Power Tables.
‡Winter conditions said to be severe ; river usually frozen over from December to March, inclusive ; glacial fed.
†Power sites on streams within the confines of Railway Belt.
§Assumed for purposes of estimate.
‖Below Palliser the valley narrows and, before reaching the Columbia valley, the river flows for several miles in a [deep] cañon, falling from ledge to ledge as a wild torrent. The fall for 10m. is about 70 ft. per m., but, in the cañon, [the] grade is steeper. See *Report of Geological Survey of Canada*, Vol. I, Part B, p. 141 ; also *Altitudes in Canada*, [by] James White, 1915 ed., p. 15.
x Drainage area above mouth ; y—drainage area above lake outlet.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Canon creek (5m. south of Golden)	*	*	*	
†211 Cañon No. 1, 4m. long (foot of cañon 1m. above mouth)	50	800	1,500	850 ft. fall in 4m. rapids ; rocky cañon, precipitous walls; Columbia River Lumber Co. has small dam near foot of cañon. More rapids and cañons further up.
TRIBUTARIES TO COLUMBIA RIVER—SOUTH OF RAILWAY BELT, EAST				
Spillimacheen river :				
212 Rapids in cañon (3m. from mouth)	605	200	4,400	Cañon, broken rocky walls 40-80 ft. high ; 180 ft. fall in 1m. ; possible dam-site. No natural storage ; severe winter conditions.
Bugaboo creek :‡				
213 Falls and rapids in cañon (2m. from mouth)	100	220	800	Two falls ½m. apart ; one at head of cañon is 60 ft. ; balance of head in steep rapids, grade 90 ft. per m., above and below ; steep rocky banks 40 ft. high. Further investigation necessary to determine most economical head.
214 Falls and cañon (near trail crossing 8m. from mouth)	....	60	200	50 ft. fall in 400 ft. ; series of small falls ; deep, narrow rock cañon, walls 70 ft. high below falls.
214 Falls 16m. above mouth	....	40	100	Falls of 37 ft. ; banks, gentle slopes between falls, suitable for fluming.
214 Falls and rapids, 17m. above mouth	....	120	300	12 ft. fall and 115 ft. in 1m. rapids.
South fork Bugaboo creek :‡ Rapids, ½m. above mouth	....	160	200	Falls 160 ft. in 3,000 ft. ; series of steep rapids. Has about one-third flow of main stream below confluence.
Templeton creek :				
215 Rapids in cañon (6m. above mouth)	....	350	300	230 ft. fall in 1,200 ft. and 100 ft. in 600 ft. rapids in deep, rock cañon ; head optional.
Dunbar (South Salmon) **creek :** (trib. Templeton)				
216 Rapids in cañon (3m. from mouth)	95	600	2,000	2½m. of cañon, 100 ft. fall in 500 ft.; total of 600 ft. in 2m. of cañon ; head optional. 900 ft. is available in 3m.
Sinclair creek :				
217 Falls in rock cañon (2m. above mouth)	25	120	55	Fall of 63 ft. ; rapid below, 57 ft. in ½m. in narrow cañon 10 ft. wide ; above falls, perpendicular cañon walls, 100 ft. high. Might be developed for small power and then used for irrigation.
Forster (No. 2) **creek :**				
218 Forster falls (3m. above mouth)	110	230	700	Direct fall 83 ft. ; rapids above fall, 97 ft. in 1,500 ft. ; rapids below, 50 ft. in ½m. Banks of slate and conglomerate, below falls 180 ft. high. Development attempted by tunnel (section 4 sq. ft.) ; timber dam, 70 ft. high, failed.
219 Rapids 6m. above mouth	....	30	90	Rapids 30 ft. in ½m. ; high boulder and gravel banks ; 30 ft. head possible by low dam, flume, pipe line, etc. More rapids above.
219 Fall in cañon 11m. above mouth	....	25	75	Said to be 25 ft. fall in cañon.
Frances (No. 3) **creek :** Fall 21m. above mouth	....	20	50	Direct fall of 20 ft. reported.
Horsethief creek :				
220 Rapids in Six-mile cañon and falls at head	235	200	2,000	Falls 180 ft. in 2½m. ; in 6m. falls 765 ft.; head optional. At head of cañon a series of falls gives head of 32 ft. Above falls, drains flat country sparsely timbered. Winters severe and frasil ice to be contended with.
221 Fall in cañon, 18m. above mouth	190	40	275	Fall of 15 ft. ; rock cañon, perpendicular walls 100 ft. high ; possible dam of 25 ft. ; more head might be obtained by flume.
222 Falls, 37m. above mouth	...	150	150	Falls 150-200 ft. ; rocky banks.
North fork Horsethief creek	....	230	100	Falls 230 ft. in 1,250 ft. Flow about ½ of main stream.
Boulder creek (trib. to Horsethief creek)	30	....	....	Columbia Valley Irrigation and Fruit Lands Co. take 60 sec.-ft. for irrigation.
Toby creek :				
223 Cañon 1½m. above mouth	....	60*a*	500	60 ft. head possible by dam near cañon mouth ; rock outcrops ; bed, gravel and boulders underlaid by rock.
223 Rapids 3½m. above mouth	250	200*b*	1,600	260 ft. in 2½m. rapids. By dam and flume, head 200 ft. obtainable ; *b* includes *a*. Banks covered with loose material with rock below.
223 Cañon 11m. above mouth	230	100	750	100 ft. fall in 1,200 ft. rapids ; low dam possible above cañon ; stream 50 ft. wide ; steep, rocky banks

* See Description of Power Tables.
† Power sites on streams within the confines of Railway Belt.
‡ Have been partially investigated by Provincial Water Rights Branch, British Columbia. See Report for 1914, p. H18.

COLUMBIA RIVER AND TRIBUTARIES—DISTRICT No. 1—*Continued*

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
	*	*	*	
Jumbo creek (trib. Toby creek) : 224 Fall and rapid	50	40-60	110	Fall of 20 ft. has been blasted for log driving ; 40 ft. in 1,000 ft. rapids.
Dutch creek : 225 North Fork rapids (1½m. above confluence)	60	60	100	Fall of 60 ft. in 500 ft. of rapids ; possible dam-site, 10 ft. or more.
Cold Spring creek	Small	....	....	Said to have no power possibilities.
Warm Spring creek	Small	....	....	Sulphur springs. Said to have no power possibilities.

SKAGIT RIVER AND TRIBUTARIES ‡

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
Skagit river :				
Boundary line to Klesilkwa creek	....	....	....	Has low grade.
Klesilkwa creek to Sumallow river	....	....	....	Uniform grade of about 50 ft. per m. in narrow, rocky, heavily timbered valley.
Sumallow river to Skaist creek	....	....	....	Uniform grade of about 75 ft. per mile.
Above Skaist creek	....	....	....	Grade is fairly uniform, being about 220 ft. per m.; flows in steep, rocky valley.
Lightning creek	Small	....	....	Rises in Lightning lakes. Said to have no power sites.
Muddy creek	Small	....	....	Small ; descends about 2,200 ft. in 9 miles.
Ten-mile creek	Small	....	....	Small ; said to have no special power sites.
Klesilkwa creek :	20x	....	....	In wide valley ; uniform fall of about 100 ft. per mile.
Maselpanik (Murphy) **creek** : (trib. Klesilkwa) : 226 Rapids and falls	Small	....	....	Glacial stream with dependable summer flow ; would probably afford small powers ; about 3,000 ft. fall in 8m.
Sumallow river : 227 Box cañon above mouth	86	....	....	Box cañon for 10m. above mouth, but said to have low grade; possibly low heads might be developed to give small powers. Proposed to divert head waters above Hope trail into Nicolum river to develop power.§
Canon creek	Small	....	....	Small glacial stream.
Skaist creek : 228 Rapids	54x	200 per m.	200	200 ft per m. for first 10m. Storage in lake at head. Head optional.

*See Description of Power Tables.
‡The Skagit river flows through the state of Washington into Puget Sound, and is here listed for convenience. The water power possibilities of the Skagit river and its tributaries in British Columbia have not yet been specially considered ; doubtless several small powers are available.
§Such a diversion would affect international boundary waters
x Drainage area above mouth.

CHAPTER XI

Fraser River and Tributaries—Topography and Power Site Tables

THE Fraser river, explored by Simon Fraser in 1808, is the most important river of British Columbia. In 1857 gold was discovered on it and on its tributary, the Thompson. As a result of the influx of miners—commonly known as the 'Fraser River rush'—the pack trails of the Hudson's Bay Co. were superseded by waggon roads, and steamboats plied upon the navigable portions of the Fraser and other rivers. Of these roads, the most famous—the Cariboo road—was constructed up the valley of the Fraser and of the lower Thompson.

The extensive watershed of the Fraser river stretches from south of the international boundary to north of latitude 56° N., and includes the eastern slopes of the Coast mountains to the west, as well as a portion of the Intermontane valley on the east, a total area of some 91,000 square miles. It includes practically the whole of the great Interior plateau.

The character of the country drained by the Fraser is described in the chapter on general topography of the province. It ranges from the heavily-timbered coastal valleys to the arid regions of the dry belt. Most of its watershed has some kind of forest cover. Heavy timber is found near the coast, where the fir and cedar grow to great size (See Plate 9.) Even in the dry belt, trees are generally found on the hills. On the mountain ranges the lower slopes are well wooded. Up to the present, timber cut in the interior has been mostly for local use ; but the Coast mills, in addition to supplying the local demand, ship large quantities to the prairies and to foreign countries. There are several large mills near the mouth of the Fraser, but much of the timber they cut is drawn from the lower valleys along the Pacific coast. More detailed information, respecting the character of individual portions of the watershed, is given under the description of the tributaries.*

The Fraser, from its mouth to the source near Yellowhead pass, is about 700 miles long. The headwaters of its tributaries, the Nechako and Stuart rivers, extend to a somewhat greater distance.

In the days of the gold rush and during the construction of the Canadian Northern railway, steamers ascended the Fraser as far as Yale, 100 miles from its mouth, but, as a rule, large craft do not ply above Chilliwack, 50 miles. The steamship service to Chilliwack, however, is subjected to severe competition by steam and electric lines. Tidal influence extends to Agassiz, 70 miles from the coast. At Yale the first cañon begins, and the river is confined between

* Fuller descriptions of various portions of the province may be found in the reports of the Forest Service and Water Rights and Survey Branches, Department of Lands, British Columbia. Brief descriptions of the streams in the Railway Belt are given in *Water Resources Paper No. 1*. Reference may also be made to the ***Annual Reports of the Geological Survey of Canada***. See Bibliography.

solid rock walls, which, in many places, are only 200 or 300 feet apart. In some of these restricted passages, the river, during extraordinary spring freshets, rises as much as 80 feet above low water. The Fraser cañon, 30 miles long, is noted for its rugged grandeur. Above the cañon the banks are high, but the rock outcrop is not so much in evidence. The fall from Lytton to Yale is about 280 feet in 53 miles.

As, in a general way, the great Interior plateau slopes downward towards the north, the Fraser river above Lytton lies in a deeply eroded, trough-like valley many hundreds of feet below its general surface. The height of these banks gradually decreases, but, not until Quesnel is reached, does the level of the river approach that of the surrounding country.

Between Soda Creek and Lytton, 120 miles, the river falls about 800 feet, and, owing to the numerous rapids and cañons, is not safely navigable even for canoes. Graphic descriptions are recorded by early explorers who attempted to run this part of the river.* At Soda Creek it again becomes navigable, and from this point to Prince George steamers make regular trips during the open season, the only serious obstacles to navigation being Cottonwood and Fort George cañons, both of which have been improved. (See Plate 20.) Above Prince George, except at low stages, the Fraser is navigable for stern-wheelers to Tête Jaune. Much traffic passed over this stretch during the construction of the Grand Trunk Pacific railway, but the difficulties of navigation and the completion of the railway have made its navigation unprofitable.

The watershed of the Fraser does not afford areas of agricultural land commensurate with its great expanse, but the wide stretches in the northern interior suitable for agriculture have been made accessible by the Grand Trunk Pacific railway. Near the mouth of the river very rich agricultural land is found in small benches and in extensive flats along the river bottoms. The delta of the Fraser contains some of the best agricultural land in the province. Some of it is subject to overflow, when a high spring tide with a westerly wind synchronises with a flood stage of the river. The flood stage of the river has been observed for many years. Gauge readings have been taken at Chilliwack since 1906, and are presented in Chapter XVI (See record No. 42). Only during the last few years, however, has a systematic study of the flow of the river been undertaken. At present there are two stations maintained by the British Columbia Hydrometric Survey—one at Hope, below the confluence of the Coquihalla, and the other at Lillooet, above the mouth of the Thompson.

A study of these records reveals a wide range between the high and low water flows. Though the low-water conditions are not yet well ascertained, it seems probable that the flow of the Fraser above Lytton, with a drainage area of some 63,000 square miles, occasionally falls below 5,000 second-feet. This demonstrates that, during the winter months, there are extremely low discharges from many of its northern tributaries. The amount of water carried by the tributaries depends almost entirely upon whether they derive their

* See Sandford Fleming's "Expeditions to the Pacific," in *Transactions of Royal Society of Canada, 1889.* Vol. VII, pp. 89-141, especially p. 107: Montreal, 1890.

volume from the mountains of the Coast or eastern ranges, or lie wholly within the dry belt and have their drainage areas confined to a section of the Interior plateau.

In the rapids and cañons which stretch from Yale nearly to Soda Creek, the waters of the Fraser are capable of developing, even at low stages, a large amount of power. It is true there are no pronounced falls, nor do the rapids occur in such proximity as to produce, in a short distance, any considerable head, yet there are numerous places where it would be possible to construct dams and concentrate the fall in the river. Such projects would, however, require most careful examination from the economic standpoint.

There are, moreover, several reasons why development of power on the main Fraser river will probably not very readily be undertaken—at least for a considerable time to come.

First, fishing is the most important industry connected with the Fraser and, in the summer, salmon ascend the river in countless numbers to spawn in the upper lakes and smaller streams. To protect this industry it will be necessary to preserve most jealously the physical characteristics of the stream. In 1913 and 1914, during the construction of the Canadian Northern railway, a rock slide formed an obstruction in the cañon above Yale, and, in turn, produced currents sufficient to seriously retard, or hold back, millions of salmon. The removal of the obstacle required the expenditure of over $100,000.*

Second, there are difficulties of construction. As the railway tracks are, in many places, but a few feet above extreme high water it is impracticable—below Lytton—to construct high dams, or to provide adequate means for controlling heavy flood flow.

Third, on numerous tributaries, other powers, more easily developed and within the range of economic transmission, are available. These tributary powers will make unnecessary, for many years to come, the harnessing of the main stream below Soda Creek. (For view showing characteristics of Fraser valley see Plate 19.)

Fourth, no effective storage could be obtained in the immediate vicinity of any proposed development on the lower river, hence, the low water flow, as modified by any works constructed on its tributaries, would determine the amount of power that could be made available. In the future, the lakes on the upper waters, more particularly on the Nechako river, may be used for storage.

Fraser River below Lytton

The Fraser river, from its mouth to the confluence of the Thompson river at Lytton, has a length of about 150 miles. Near the mouth the climate is comparatively mild, and the rainy season usually lasts from October till March, with only a slight snowfall in the lower valleys. The summers are cool and the precipitation adequate for the growing season. In the main valley, precipitation averages about 60 inches, but, on the upper slopes, it probably exceeds 150 inches. At Hope, about 90 miles from the mouth, the mean annual precipitation is from about

* See "Report on the obstructed conditions of the Fraser river at Skuzzy Rapids, China Bar, Hellgate and White Creek" in *Report of Commissioner of Fisheries*, British Columbia, for year 1913, p. R39; also for year 1914, p. N20. The reports include several illustrations of the Fraser River cañons.

50 to 55 inches, including a larger proportion of snowfall. Here, the winters are colder and the maximum summer temperature higher. From Hope to Lytton there is a gradual merging into the climatic conditions prevalent in the dry belt.

In the Lower Fraser valley fir, cedar, hemlock, spruce and other trees are plentiful and grow to great size—trees from 6 to 10 feet or more in diameter being not uncommon. The undergrowth of ferns, nettles, devil's club, alder, etc., is frequently very dense.

While the potential powers of the lower stretches of the Fraser are likely to remain unused for many years, the power possibilities of some of the tributaries may be developed. One has only to study the developments at the Coquitlam-Buntzen site and on the Stave river to realize that powers of great aid to industries are lying latent in many of the smaller streams of British Columbia.

Tributaries of Lower Fraser

In passing, brief mention may be made of some of the lower tributaries of the Fraser, such as Pitt river, Harrison lake, and Lillooet, Chilliwack, Coquihalla and Nahatlatch rivers.

Pitt River—From the head of Pitt lake—a tidal lake—the valley is occupied by Pitt river, which, in its upper stretches, is a rapid stream with a fairly even grade, but stated to have no large power possibilities. Numerous tributaries are swift mountain streams, with, as a rule, considerable fall near their mouths. While some particulars are available, their power potentialities are, in most cases, unknown.

Alouette River—A tributary to Pitt river below Pitt lake. About two miles from its mouth it forks, but both forks continue in the same main valley for some miles further. The main stream drains a mountainous watershed of about 100 square miles. Of this area, 60 square miles lies above the outlet of Alouette lake, which is 10 miles long and 370 feet above sea level. The proposal to divert the waters of this stream for power purposes led to the famous 'Burrard Power case,' which established the jurisdiction of the Dominion of Canada over the waters within the Railway Belt. The North fork drains an area of about 20 square miles. It rises in Golden Ears mountain, at an elevation of about 4,000 feet, is a rapid mountain stream, and has some power possibilities. It is scheduled as the possible domestic supply to Maple Ridge municipality.

Harrison Lake and Lillooet River—The small tributaries of Harrison lake have power possibilities. The Lillooet river flows into the head of Harrison lake, and drains a watershed of about 2,200 square miles. The portion of Lillooet river above Lillooet lake is about 50 miles long, drains an area of 1,600 square miles and rises in the mountainous country north of Jervis inlet; near the Pemberton meadows, at the head of Lillooet lake, it has a tortuous channel and is sluggish. These meadows are subject to flooding, and a scheme has been proposed to drain them by lowering Li[illegible] lake. The lower portion of the river falls about 640 feet between Lillooet [illegible] Harrison lakes—a distance of 30 miles.

Plate 25

QUESNEL RIVER—DEVELOPMENTS IN CONNECTION WITH GOLD MINING

A.—Dam at outlet of Quesnel lake, showing sluicegates.
B.—Dam at outlet of Quesnel lake, showing spillway.
C.—View on Twenty-mile creek, showing typical hydraulic placer min

Chilliwack River rises in Chilliwack lake, which has an area of 2,600 acres, at an elevation of 2,130 feet. It now discharges into Sumas lake—low water, 9 feet ; extreme high water, 36 feet. The Chilliwack formerly flowed into the Fraser river through a number of channels, but some twenty years ago it was diverted by a dam, through Vedder River channel, into Sumas lake. Its watershed is well wooded, is mountainous and approximates 450 square miles. About one quarter of this lies in the state of Washington. The valley is in the coastal region and probably has an annual precipitation of 40 to 70 inches. The fall of 2,000 feet in about 25 miles indicates that the Chilliwack possesses power potentialities. There are, however, no pronounced falls, and any development might prove expensive. Control of its severe freshets would greatly benefit agricultural lands near its mouth.

Coquihalla River is a swift mountain stream ; it falls into the Fraser at Hope and drains a watershed of about 335 square miles. The mountains rise steeply from the narrow valleys of the main stream and its tributaries, the river being frequently bordered by steep cliffs. The vegetation is coastal and undergrowth is dense.

In 33 miles it descends 3,000 feet in a succession of rapids, without any very pronounced falls. There is, however, one descent of 15 to 20 feet about one-half mile above the Natural bridge, and several schemes for its development have been proposed. In 1913, the British Columbia Water Rights Branch investigated* the power possibilities near its mouth, where there are three distinct box cañons with rock walls, almost overhanging the water in some places. Alternative schemes have been suggested. In each case, an intake dam 60 feet high, at the head of the upper box cañon about 5·3 miles from the mouth, has been proposed. One scheme proposes a tunnel 2,600 feet long, developing a head of 225 feet ; the other, a tunnel 3,900 feet long, developing a head of 315 feet. The suggested dam would flood about 140 acres, but no extensive storage could be provided without high and costly dams. The power development, consequently, would be limited by the low-water flow. The proximity of the Kettle Valley railway would have to be considered in any proposed power development.

Nahatlatch River is the largest tributary of the Fraser between Hope and Lytton. It rises in the Coast mountains and drains approximately 425 square miles. There are four lakes. The upper three lakes are at practically the same elevation and aggregate 7 miles in length. The fourth and lowest lake is about one-half mile long and receives the drainage from an area of 300 square miles. Above it the river falls 15 to 20 feet in one-half mile of rapids. Below the lowest lake, a dam could be built which would 'drown out' all the lakes and would flood portions of a wide valley above the uppermost lake. The lakes are at an elevation of about 900 feet. Below their outlet the river falls 550 feet in a series of rapids 8 miles long. Two important tributaries join the river below the lake. A fairly large power development is possible on this stream, but its cost would require careful investigation.

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* See *Annual Report of Minister of Lands*, British Columbia, for 1913, p. D147.

Thompson River

The Thompson river was named after the famous geographer, David Thompson. It is the most important tributary of the Fraser and drains one of the more settled areas of the interior of the province.

The Thompson river, from the head of the North Thompson, is 280 miles long and drains an area of about 21,500 square miles. The North Thompson and South Thompson have their confluence at Kamloops. The North Thompson has considerably the heavier mean flow and drains a watershed of about 7,850 square miles, while the drainage area of the South Thompson is about 6,750 square miles.

In summer, the Thompson river is navigable from Kamloops lake to Shuswap lake on the South branch. The North Thompson is also navigable from Kamloops upstream for 90 miles and also along certain stretches above this point.

For purposes of description it is convenient to consider the watershed drained by the Thompson as subdivided into two main sections: First, the area lying in the dry belt; second, the area further east, draining a portion of the westerly slopes of the Monashee mountains. While these areas gradually merge into each other, marked differences of precipitation over these two regions reflect striking differences in attendant phenomena.

In the dry belt the plateaus are generally covered with scattered bull pine and small timber, and the valleys are narrow. There are also mountains with elevations of 5,000 to 6,000 feet, on which are found good fir and some cedar and hemlock. (See Plate 10.)

The climate of the dry belt is characterized by a low mean annual precipitation of from five to fifteen inches. The summer rainfall is small and the snowfall varies from one to two feet in the valleys to four to six feet in the hills. The summers are very hot and dry, with cool nights. The winters are dry and cold, with short spells of extreme cold, when the thermometer may drop to 40° below zero.

Owing to the requirements of irrigation, the stream-flow of the dry belt has been specially studied by officers of both the Dominion and Provincial governments. Up to the present time, nearly all the irrigation in British Columbia has been based on gravitation supply from the smaller creeks. Comparatively little has been done to store the waters of the spring floods and still less to provide a supply from the larger rivers by pumping.

The warm sun in April and May, assisted by Chinook winds, melts the snow, and freshets occur usually about the second or third week in May. The flow decreases in June, and, during July and August, when the water is required for irrigation, many water-courses are almost, or wholly, dry. The autumn rains are light and cause a barely perceptible increase in the flow, while in winter the creeks are frost-bound.

The foregoing demonstrates that, in the valleys of the lower Thompson and of its tributaries, the interests of irrigation are paramount. There are, however, some streams on which power developments, possibly in connection

with irrigation projects, might be undertaken in order to provide, at certain seasons, a limited amount of power.

Between Kamloops lake and Ashcroft, 20 miles below, the Thompson river falls 200 feet. Between Ashcroft and Spence Bridge it falls 225 feet in 25 miles, and between Spence Bridge and its mouth, at Lytton, it falls 320 feet. For reasons explained more fully in discussing the Fraser river, the chief being the railways constructed on its banks, it is improbable that any attempt will be made in the near future to develop the large water-power potentialities of the Thompson.

The more easterly portion of the Thompson watershed includes the tributaries to Shuswap lake (except Salmon river which lies in the dry belt) and the upper portion of the North Thompson and its tributaries. The agricultural development is here less advanced and much of the ground is rolling and rather hard to clear. There is good timber in the valleys and on the mountain slopes. The high water elevation of Shuswap lake is 1,149 feet. The mountains at the headwaters of its tributaries rise to elevations of from 6,000 to 8,000 feet.

The precipitation over this portion of the watershed ranges from 15 inches on the borders of the dry belt to 40 or 50 inches on the higher mountains. The runoff from the various streams reflects this higher precipitation, and the district is well supplied with water-power. Several small streams have been developed, the most important being the Kamloops city plant on Barrière river.

Tributaries to Thompson River

The more important tributaries of the Thompson are as follows :

Nicola River drains an area of 2,650 square miles. It flows out of Nicola lake at an elevation of 2,020 feet and descends 1,300 feet in 45 miles to its mouth at Spence Bridge, its watershed lying in the dry belt. The Nicola valley is a well-known ranching country, and mining is also carried on. The water-power possibilities are limited to a few very small powers on some of the tributaries. The Canadian Pacific railway follows the banks of the main stream and would render it difficult to make any developments thereon.

Bonaparte River drains an area of 2,050 square miles. The watershed lies in the dry belt, and the waters of the streams are required for irrigation. There are several lakes at its headwaters at elevations of from 2,000 to 4,000 feet ; the largest, Bonaparte lake, is about 10 miles long, 2 miles wide, and at 3,834 feet above sea. Much of the lower land is irrigated and is now under cultivation. North of the Railway Belt the altitude of the valleys is higher, hence the precipitation is a little heavier, and there is more timber. For the last four miles of its course the river flows through a deeply eroded cañon. A small development was made here for lighting the town of Ashcroft, but in the spring of 1913 the plant was put out of commission by a washout.

Deadman River drains an area of 500 square miles. It rises in several small lakes at elevations of about 4,000 feet. It is in the dry belt and, while power developments would be subservient to irrigation interests, there are several small power possibilities.

Adams River has a drainage area of about 1,215 square miles. There are large areas of valuable timber on the watershed, and the Adams River Lumber Co. has built a dam for lumbering purposes about a mile below the outlet of Adams lake. The lower river offers an excellent power site and Adams lake—area of about 54 sq. miles—affords valuable storage. This potential power is of great economic importance in connection with the development of this territory.

Shuswap River, also tributary to Shuswap lake, drains a watershed of 2,050 square miles. There are two power sites on this river, one below Mabel lake and one at the cañon 12 miles above Mabel lake. In connection with the latter, extensive studies have been made under the direction of Mr. A. R. Mackenzie, for the Couteau Power Co. (see p. 173), and an ultimate development of about 18,000 h.p. is contemplated. (For Shuswap River cañon see Plate 21.)

The tributaries of the North Thompson are not as well known as those of the South Thompson. The Barrière river has been partially developed by the city of Kamloops. On Murtle river, tributary to the Clearwater, there is an undeveloped power of considerable magnitude. Many other tributaries to the North Thompson, particularly those from the east, are known to possess opportunities for smaller developments. See list of water-powers for a summary of the information available.

Tributaries to Fraser above Confluence of Thompson

Bridge River is the first large tributary to the Fraser river above the confluence of the Thompson. It was explored by miners in 1858, and was prospected nearly to its source. The valleys of its upper tributaries penetrate the eastern slopes of the Coast mountains. It drains 2,540 sq. miles of extremely mountainous country. Bridge river may be divided into four portions, *viz.*, the river below the cañon, the cañon itself, the river immediately above the cañon, and the upper waters. Bridge river, between its mouth and the confluence of the North fork—a distance of 16 miles—has alluvial benches at each side and lies in a narrow valley between steep mountain slopes. There is insufficient precipitation for agricultural purposes, but the benches, when irrigated, yield good crops. The cañon is situated above the confluence of the North fork. It is 12 miles long and is very rugged. The fall in the cañon averages over 50 feet to the mile, and, being fairly evenly distributed along its length, produces a succession of rapids. It is, generally speaking, a succession of narrow gorges followed by wider gravel bars ; at places it narrows to a width of 120 feet. Upper Bridge river—the stretch above the cañon—is a sluggish stream flowing through a narrow valley, at no place more than a mile wide. The banks are low and are overflowed during the freshet season. The valley is bounded by steep mountains. (For dam-site in Bridge River valley see Plate 24.) The upper waters consist of several mountain streams, draining, for the most part, narrow valleys. There are a number of mines on these streams, chiefly on Cadwallader creek.

There are no large lakes on Bridge river or its tributaries, and the runoff varies between wide limits. The precipitation increases towards the head-

waters. Power developments on the Bridge River watershed are limited to a few mining plants on the tributaries, but the contemplated diversion of the waters of the main stream to Seton lake, by means of a tunnel, constitutes one of the larger power potentialities in this part of the province. (See page 171, for further details.)*

Chilcotin River

The Chilcotin river is about 145 miles long and drains an area of about 7,000 square miles of the westerly section of the great Interior plateau.†

Southwestward from Chilcotin post office, the country has a rolling surface, spreading wide and sloping slightly towards the Chilcotin valley, which appears like a deep gash in the midst of an extensive plateau. Beyond the valley the plain extends for many miles, inclining slowly upward to the gentle slopes of a bounding range of wooded hills, above which rise the snow-clad peaks of the far distant Coast mountains. (For view of Chilcotin valley and plateau, see Plate 22, also compare view opposite p. 236 in *Report of Geological Survey of Canada* for 1875-76.) The Chilcotin plateau is generally open and prairie-like, diversified with patches of woodland and covered with a good growth of bunch grass. This forms a fine stock-raising region, and parts of it are already occupied by ranchers. The district is, in large part, underlain by Tertiary rocks, chiefly volcanic.

The greater portion of the Chilcotin watershed lies in the dry belt. The branch which retains the name Chilcotin gathers its waters from several creeks, which, in turn, drain small lakes lying on the plateau about 50 miles east of the Coast mountains. This branch has a small flow, and has no important falls or rapids. The major portion of the flow of the river comes from the south branch, the Chilko, which drains Chilko lake.

Chilko lake, one of the larger lakes of British Columbia, is about 48 miles long, from 3 to 4 miles wide, about 97 square miles in area and lies partly surrounded by high mountains of the Coast mountains, many of which are snow-covered all the year. It is about 3,880 feet above sea and may afford storage. Some of its tributaries have their source in glaciers.

At the confluence of the Chilko and Chilcotin the river lies about 200 feet below the general surface of the country (see Plate 22). Downstream the valley gradually deepens and widens and, at Hanceville, 25 miles below, it is 400 feet below the plains. At its confluence with the Fraser, 28 miles below Hanceville, the floor of the valley has dropped until the river is no less than 1,800 feet below the general level of the Central plateau. Except at one or two points, where there are short cañons, the river flows between banks composed chiefly of sand and gravel, with occasional "slides."

The chief power site listed in the tables is at the first cañon. Here the walls are of rock and rise to a height of over 80 feet. The rock channel proper has a length of about 800 feet. Above and below the cañon the river has clay cut-banks varying in height from 300 to 500 feet above low water. Back

*See "Report on Bridge River" in *Annual Report of Minister of Lands*, British Columbia, for 1912, pp. D273, *et seq.* Also, *Annual Report of Minister of Mines*, British Columbia, 1910, pp. 134, *et seq.*

† See *Report of Geological Survey of Canada*, 1875-76, p. 234, *et seq.*

of these there are a few narrow benches, wooded on the south, but open and grass-covered on the north. Steep side hills rise to the general level of the open prairie country at an elevation of between 1,800 and 2,000 feet above the river bed. Other power possibilities are said to exist on Big creek and on Taseko (Whitewater) river, but the district as a whole does not appear to afford much scope for desirable developments.

Quesnel River

Quesnel river, named after Jules Maurice Quesnel, is one of the more important tributaries of the Fraser. Its watershed has an area of about 4,500 square miles and includes a large area in the southern portion of the Cariboo range. The North fork drains about 1,000 sq. miles and the South fork about 2,500 sq. miles.

The Cariboo district may broadly be divided into two parts : First, that portion of the country which has an elevation above sea level of from 1,800 to 4,000 feet, and comprises the large valleys and plateaus of earlier periods, which are traversed by the larger old river channels, such as the Quesnel River system ; and, second, the more elevated portion, as represented by the mountainous region around Barkerville.

In the lower territory the gravel-bearing streams, after leaving the confines of the more enclosed valleys, issue into wider and more level valleys or plains. Here, for the most part, their courses are less rigidly defined, their flow being slower and their channels larger.*

There is a marked difference between the climates of the lower Quesnel valley and the upper portion of the watershed. Thus, at Quesnel, the mean annual precipitation is about 14 inches, and, in dry summers, irrigation is practised ; while at Quesnel Forks and above, the physical appearances indicate a considerably greater precipitation. The lower river valley, in general, passes through a district composed of gravelly hills, and high bench lands thinly timbered with poplar, birch and other small growth. Few patches of old timber remain. Some years ago, a large portion of the district was swept by a destructive fire. About five miles above the mouth of the river, is the 'First' cañon—simply a great gash cut by the river in the gravel banks, which are constantly sliding into it. This so-called 'cañon' is not suitable for power development. From the 'cañon' to the Forks the character of the river does not vary greatly. The channel in many places is obstructed by gravel bars formed by the frequent slides. (For typical country in vicinity of Quesnel river, also cut-banks, see Plate 23.)

Between the mouth and the Forks there is only one favorable site for substantial power development, namely, at a rock cañon about 20 miles upstream. Here the river narrows to a width of 100 to 250 feet, and falls about seven feet in 2,000 feet. The cañon has rock walls and forms an excellent dam site. Probably a head of from 25 to 40 feet might be obtained. None of the tributaries below the Forks afford scope for large power development—the largest, Beaver creek, has a normal summer flow of about 30 to 50 second-feet at its

*See "Report on the Geology of the Mining District of Cariboo," by Amos Bowman, in *Report of Geological Survey of Canada*, Vol. III, 1887-88.

mouth, and is said to be almost dry at low water. (For power site on Quesnel river see Plate 23.)

The North fork of the Quesnel drains Cariboo lake and the South fork carries the discharge of Quesnel lake. Cariboo lake is 10 miles in length by one mile in width, and occupies the southern end of a low depression which is drained by Swamp river and extends many miles to the north. Quesnel lake has an area of about 133 square miles, and extends easterly in a narrow valley for some 70 miles, having a north arm about 18 miles long. It is usually closed by ice from November to March. The North fork drains a district which appears to have an average precipitation rather larger than that of the area drained by the South fork. Owing to the regulating influence of Quesnel lake, especially as modified by the dam at the outlet, it is probable that, on the South fork, the range between high and low water is less than on the North fork.

The difference of elevation between Quesnel Forks and Quesnel lake—a distance of seven miles—is 235 feet. If a dam of sufficient height to regulate the lake level were erected below the outlet of Quesnel lake and a flume and pipe-line constructed to a power site on the South fork, one mile above Quesnel Forks, an effective working head of 200 to 220 feet might be secured. A favourable location for the pipe-line might be found along the benches adjacent to the road from Quesnel Forks to the lake.

In view of the fact that storage is afforded by Quesnel lake, that the watershed lies in a region of considerable precipitation, and that the development would be comparatively easy, this is probably the best large power possibility on the tributaries of the Fraser north of Bridge river, and hence is of great economic importance in connection with the development of this part of the province. Alternative methods for developing this head are suggested in the tables, but the scheme outlined above would probably prove the most satisfactory.

The North fork of the Quesnel is not so large as the South fork. For the first six miles it is a swift stream with, here and there, broken water. It flows between high gravel banks, and has, in places, cut-banks several hundred feet high. The falls, two miles below Cariboo lake, have a descent of 12 feet. The additional fall in rapids above and below gives a possible head of 60 feet in half a mile. Suitable dam sites exist, and a dam near the falls would control Cariboo lake for storage. Below the falls the North fork descends between 30 and 40 feet per mile and additional head might be developed by fluming along the northwest side of the river. (For views on North and South forks see Plates 24 and 25.) For a similar distance the total head obtainable on the North fork might be rather more than on the South fork but, owing to the smaller watershed and the lesser facilities for storage in Cariboo lake, less power would be secured. In addition to these main power sites there are no doubt several streams tributary to Quesnel and Cariboo lakes which would afford opportunities for smaller developments for mining and other local purposes.

The Cariboo district has, for over half a century, been famous for its gold-bearing streams. In the past a large amount of gold has been taken from the

placers of the Quesnel and lesser streams in the Barkerville district. In 1896-97, a dam* was constructed at the outlet of Quesnel lake at a cost of $250,000. It cut off the supply of water to the South fork, but unfortunately the amount of gold found in the river bed proved insufficient to make the undertaking profitable. (See Plate 25.)

Works for the control of water for mining purposes are usually constructed for temporary use only. Thus there are throughout the province, and especially in the Cariboo district, a great number of abandoned ditches and appurtenant works. The ditches are the most permanent of all the evidences of past activity, and may be followed around the hillsides for many miles. References to these old plants are made in the *Reports of the Minister of Mines*, British Columbia. The most extensive installation of its kind in British Columbia is that of the Quesnel Hydraulic Gold Mining Co. on Twenty-mile creek, a tributary of the Quesnel, about five miles below Quesnel Forks.† (See Plate 25.)

The widespread occurrence of gold in the gravel deposits of the Quesnel river had long been known. To secure an adequate water supply at sufficient elevation for hydraulic mining operations, the Quesnel Company installed an extensive system for the diversion of water from Swift river to Twenty-mile creek. The ditch system is 25 miles long and includes three inverted siphons. The diverting dam is 35 feet high and 600 feet long, the catchment area is about 200 square miles and the working head about 500 feet. The cost of the entire equipment is said to have been about $1,000,000. Very extensive tests of the gravel deposits were made previous to the installation of the plant, but the practical working did not come up to expectations and, in 1913, the plant was shut down.

Blackwater River

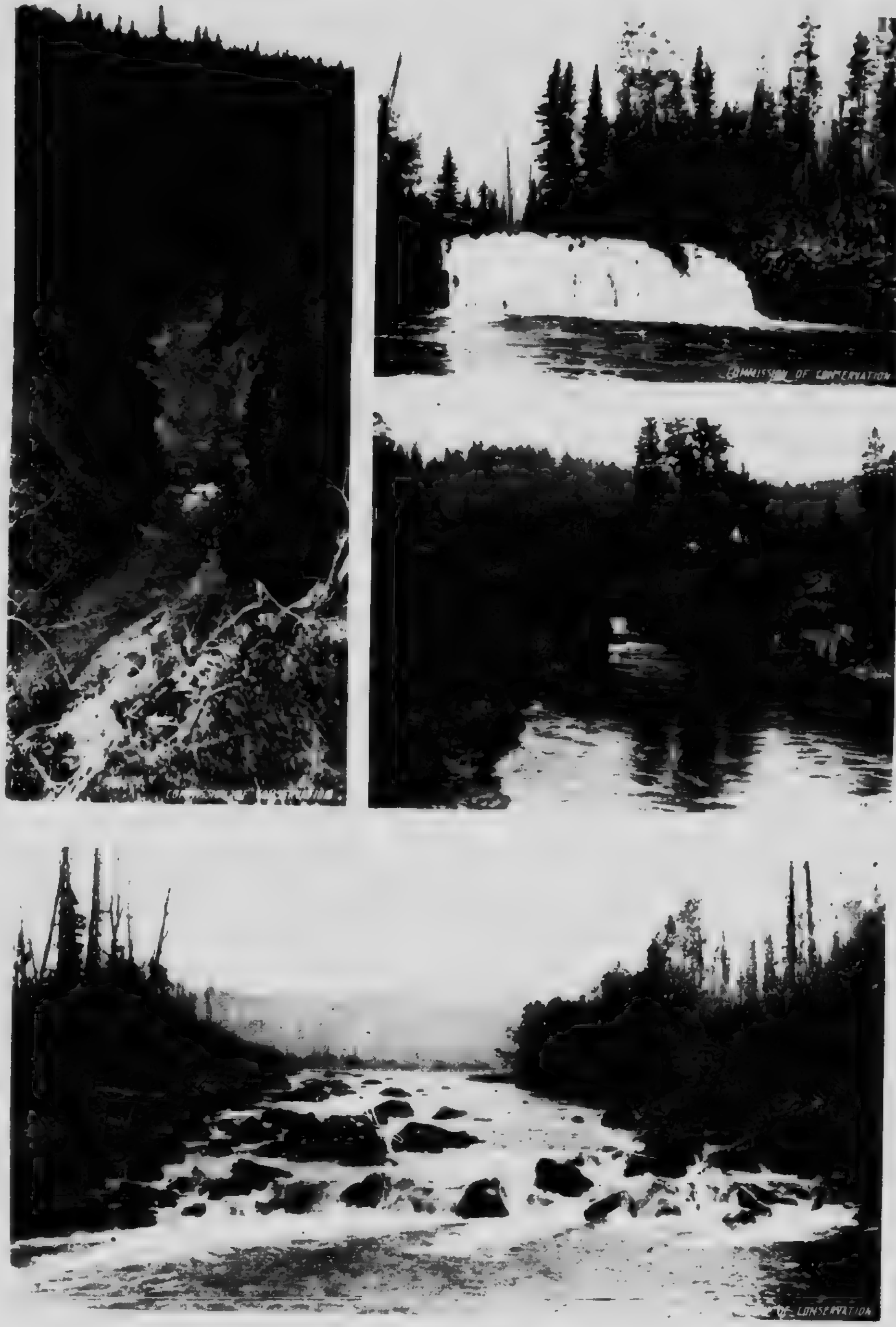
The Blackwater river discharges into the Fraser from the west, 35 miles above Quesnel. As the West Road river, it is mentioned in the *Travels of Alexander Mackenzie*, as the point at which he left the Fraser and struck westward on his famous overland journey, in 1793, to the Pacific. It drains 5,000 square miles of the Interior plateau, and is about 150 miles long. East of the Telegraph range it flows through a deeply-eroded channel, about 200 feet below the level of the plateau.‡

The Blackwater rises on the slopes of the Itcha and Ilgachuz mountains, isolated ranges rising to an elevation of 2,000 to 3,000 feet above the plateau. Compared, however, with the great peaks of the Coast mountains lying to the west, their mass and altitude are insignificant, and cannot seriously modify the climate of the district. Precipitation, however, is probably rather heavier in their immediate vicinity. Snow may usually be found on their northern

* A raceway is cut out along the north bank of the river. It is faced with cribbing and sheet piling, is 400 feet long, 127 feet wide and has 9 regulating gates, each 12·4 feet wide at the upper end. These gates may be raised to an extreme height of 19 feet. To the right of the raceway and at the upper end of the island is a pier 220 feet long and 17 feet high above low water. The remaining section of the dam is in the form of a segment of circle of 415 feet radius. It is 93 feet wide at the base with a planked slope, heavily rocked, sloping upstream for a distance of 36 feet. The crest of the weir is 10 feet wide and 5 feet above average high water, or 12 feet above low water.

† A full description of this plant, supplemented by many illustrations, is to be found in the *Reports of the Minister of Mines*, British Columbia, for the years 1910, p. K47, and 1911, p. K52.

‡ See *Geological Survey of Canada, Report of Progress, 1875-76*, pp. 241 *et seq.*



BLACKWATER RIVER

A.—Second cañon near mouth. Very typical of many deeply eroded river channels in the interior of the province
B.—Fall below Tsacha lake.
C.—Cañon at Telegraph Trail crossing.
D.—Cascades below Chine lake.

slopes during the greater part of the summer months, and it is from this source that the Blackwater river derives the bulk of its summer flow. The Telegraph range is not of sufficient elevation to affect, to any great extent, the climate of this district.

The watershed of the Blackwater river lies entirely within the dry belt. There are no precipitation data from stations within its borders. An estimate, based on the record of the nearest stations and on reports from various sources, would indicate an annual precipitation of from ten to fifteen inches. However, where affected by local ranges of mountains, the quantity may either be increased or decreased. The upper part of its watershed, except in the immediate vicinity of the Itcha and Ilgachuz mountains, probably has less precipitation than the more easterly portion.

The timber is mostly jackpine, with some small spruce, poplar and willow brush on the bottom lands. There is little undergrowth except on the river banks, and much of the wooded country is of an open, park-like character. Considerable areas on the western side of the Telegraph range have been devastated by recent forest fires, and very little old timber remains on the watershed.

Of the rivers of the province which drain areas in excess of 3,000 square miles, the Blackwater probably has the lowest runoff per square mile.* There are numerous small lakes in the Blackwater district, and some expansions of the river and its tributaries, but their combined area is not great, neither do they afford much opportunity for storage. A slight improvement might be made in the regimen of the stream, by the control of the discharge above the cascade at the outlet of Cline lake, and possibly below the outlet of Tsacha (Long) lake, some distance above the waterfall.

Opportunities for extensive power development on the Blackwater do not exist. Details of the possible power sites are given in the tables. The chief points where small powers might be developed are at Blackwater cañon ; the rapids in the Telegraph range ; at the cascades and at the waterfall. (See Plate 26.)

Nechako River

Of the tributary drainage areas of the Fraser, the area drained by the Nechako is next in magnitude to the Thompson River watershed. The total watershed of the Nechako is about 17,900 square miles, thus exceeding the area—14,300 square miles—drained by the Fraser river above their confluence at Prince George. The upper Nechako —the portion of the river above the mouth of Fraser Lake stream—rises on the eastern slopes of the Coast mountains and flows, in an easterly direction through the Tetachuck Lake and Ootza Lake branches to Natalkuz lake, thence northeasterly to its confluence with Fraser Lake outflow. The watershed of the upper Nechako, including the Fraser Lake tributary, is about 9,000 square miles, of which 5,000 square miles lies above the outlet of Natalkuz lake.

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* The small discharge of the Blackwater was commented on as early as 1828 ; see *Peace River, a Canoe Voyage from Hudson Bay to Pacific* ; Malcolm McLeod, 1872, on p. 31. "This stream [*i.e.* Blackwater river] . . . . has hardly a drop of water in it."

The 'dry belt' extends over a large part of this watershed, and the flow of the tributary streams depends upon the character of their respective watersheds. Probably more than 75 per cent of the flow at Fraser Lake confluence comes from above Natalkuz lake. In summer the discharge from Cheslatta lake falls to less than 40 second-feet.

Valuable storage could be obtained on François lake for the power site at its outlet. The discharge of the lake is affected by the direction and strength of the wind. The outlet from François lake is quite restricted, the waters flowing through a deep cañon. Its tributary watershed, however, is relatively small, and does not extend to the Coast mountains. The Entiaco, Endako and Tatalkuz, tributary streams, are small.

Storage may be secured on numerous rather large lakes, such as Tetachuck, Natalkuz, Cheslatta, François, and possibly also at the outlet of the Eutsuk lake. Many tributaries of the Nechako rise in the snow-covered peaks of the Coast mountains. This, in conjunction with the regulating effect of the lakes, even under natural conditions, indicates the probability that the discharge from the Nechako is more uniform than that from other tributaries of the Fraser.

Particulars of the various power sites are listed. The Grand cañon is worthy of further investigation. If developed, in conjunction with a storage site at Natalkuz Lake outlet, it might form a valuable power. (See Plate 27.)

The lower Nechako flows through a country described as "constituting the greatest connected region susceptible of cultivation in the province of British Columbia,"*—but possibly an exception would have to be made in favour of the Peace River territory. The Grand Trunk Pacific railway follows the Nechako valley from Prince George to Fraser lake. This district is developing, and will, no doubt, eventually become one of considerable agricultural activity. The Chilako valley and the country bordering the Nechako river, especially on the south side, contain a large area of land suitable for agriculture. There are many extensive patches of open grassy land and occasional fine groves of cottonwood of good size.

Arid or semi-arid conditions are maintained from the eastern foothills of the Coast mountains, westerly, to the Telegraph range; but, east of the latter, there are clear evidences of a greater precipitation which, in normal years, is probably sufficient for agricultural purposes.

The country between Fraser lake and Prince George, through which the lower Nechako flows, has the appearance of an extensive fertile plain, comparatively level and well wooded. From the river, no high hills are visible. About a mile below the Fraser Lake stream, there is a rapid with low cliffs of basalt. Seven miles below, the river becomes contracted and rapid and breaks through some low rocky hills. Ten miles below, a second rapid occurs, with small rocky islets, and from this point to the junction of the Stuart—38 miles—the river flows in a fairly direct course.

On the upper part of this 38-mile stretch, the land level seldom rises 50 feet above the stream, but, as the river descends, it eventually appears to stand

* See *Report, Geological Survey of Canada*, 1879-80, p. 30B.

about 100 feet above it. For ten miles below the mouth of the Stuart, it flows through flat country, with several lower benches between the river and the general level of the plain. The river here turns northward and describes a semicircle in passing through a low range of rocky hills, on the east side of which is a rapid, one of the worst on the lower Nechako. Thence, to the mouth of the Chilako, it is rather crooked and is depressed 150 to 200 feet below the general level of the surface of the country. From the mouth of the Chilako to Prince George the river is rapid and shallow.*

Stuart River

The Stuart river rises in Stuart lake, and is the chief tributary of the lower Nechako. Its drainage area of some 5,600 square miles includes several large lakes, and extends northwest for over 200 miles, to north of latitude 56°. From Stuart lake to the Nechako river its course is 50 miles in length and, except at two or three points, its flow is sluggish. The banks are generally low and flat, the level country extending about ten miles on each side of the river.

The waterways from Prince George to Fraser lake and the Stuart river and lake are all navigable at certain stages by small stern-wheelers, but the proximity of the Grand Trunk Pacific railway will lessen the necessity for water transport on the lower Nechako. Should future development make it advisable, it would be possible to improve the Stuart river so as to provide a water route from the Nechako to the head of Tacla lake.

The precipitation over the Stuart River watershed, while usually sufficient for agriculture, is not heavy and, consequently, the low-water flow is comparatively small.

As might be expected in a country with the characteristics of that drained by the lower Nechako, the water-power possibilities are neither numerous nor large. There are two sites on the Stuart river, and possibly two or three on the lower Nechako. In each case it would be a low-head development, involving the construction of expensive works. Moreover, on the Nechako, the proximity of the railway tracks and the possibility of damage by back-flooding would in some cases limit the head. At the upper site on the Stuart river a dam might be built to control Stuart lake for storage. No large power possibilities have been found on the adjacent tributary streams. It may be pointed out, however, that, when the demand is sufficient to warrant the development of the power available on the upper Nechako, the surrounding district is well within the radius of modern high tension transmission.

Upper Fraser River

Between Prince George and the mouth of Bear river, the upper Fraser river makes its great northern 'bend' around the hilly country north of the Cariboo mountains and almost reverses the direction of its flow from south at Prince George to northwest at Bear river. Between Bear river and Tête Jaune, the Fraser flows in the great Intermontane valley, elsewhere described.

Descending the upper Fraser valley, the flat land commences about 10 miles above Tête Jaune near the confluence of Grand Fork river. At

* See, *Geological Survey of Canada, Report of Progress for 1876-77*, pp. 52 *et seq.*

Tête Jaune the valley is two miles wide, and, from this point, it maintains a northwesterly course for 150 miles, gradually increasing to four miles in width at Goat river, and to about eight miles at Catfish creek. The valley floor is at a mean elevation of 2,250 feet above sea level, and is bounded on each side by high mountains from 6,000 to 9,000 feet in elevation. The highest peak of the Rocky mountains, mount Robson, elevation 13,068 feet, is at the head of the Grand Fork tributary.

The larger part of the upper Fraser valley was, at one time, covered with heavy timber. At the present time, there are patches, mostly near the foot of the high bordering mountains, which, in the size of the individual trees and the density of the undergrowth, resemble the Pacific Coast forests. Forest fires have destroyed large areas. At present, except for the patches of large timber above mentioned, the valley is covered with a light growth of jackpine (up to 18 inches, with an area of second-growth spruce, fir and cedar (up to 30 inches). The banks of the river are generally bordered by cottonwood, alder and willow.

The lower and more northern portion of the valley has a somewhat higher precipitation than the southern portion of the valley and the timber growth is correspondingly heavier.

The valley contains considerable areas of land suitable for settlement. The bottom lands are from five to twenty feet above the river and the bench lands from 40 to 200 feet higher. For some time to come, lumbering will probably constitute the chief industry in the valley.

Throughout its entire length, the river follows a very winding course, meandering from side to side of the valley. The current varies from two to seven miles per hour, but, in general, is about three miles. During high-water stages the river was navigated from Prince George to Tête Jaune during the building of the Grand Trunk Pacific railway in 1912 and 1913, but, with the passing of railway construction, most of the traffic disappeared.

Except, possibly, at the Grand cañon, 100 miles above, there are no power sites on the main river between Prince George and Tête Jaune. Several of the tributaries, more particularly those coming from the Rocky mountains, afford possibilities for power developments, and, on some of these, storage lakes at considerable elevation above the main valley are reported. This territory, however, has not been examined in detail and its power possibilities are by no means adequately known.

The higher reaches of the upper Fraser extend to the vicinity of Yellowhead pass. Six miles below the summit, and a mile west of Yellowhead lake, it enters the main valley. The valley is wide and partly open. About 20 miles from the summit the Fraser flows into Moose lake, which is 7½ miles long and one mile wide. South of the lake the mountains rise abruptly from the water's edge, while to the north the country inclines moderately for some distance before the steeper slopes begin. Issuing from Moose lake, the Fraser moves sluggishly in a wide channel for two or three miles, then it narrows, and, taking a steeper grade, rapidly descends. Further on, the valley becomes more confined and the hills close in on both sides. The narrowest point is some eight

miles below the lake, after which it again widens. Downstream, fourteen miles from the lake, the river is joined by the Grand fork. In this portion of its course, it is joined by several tributaries and, while power development is feasible at one or two points on the main river, the tributaries probably offer more attractive possibilities.

The chief tributaries of the upper Fraser are the Salmon, Willow, Bowron (formerly Bear), and McGregor (formerly North fork) rivers. The main branches and tributaries of the McGregor river have not been examined for power sites. They drain two narrow valleys parallel to the main range of the Rockies. The Salmon river has no large power possibilities. There are some power sites on both the Willow and Bowron rivers, described in the tables. (See Plate 27.)*

*For fuller description of Upper Fraser valley, see *Annual Reports of Minister of Lands, British Columbia*, for 1912, pp. D284-291; and for 1913, pp. D427-433; also, see *Geological Survey of Canada, Annual Report* (new series), Vol. XI, 1898, 78-79A; 15-20D and 32-35D.

Fraser River and Tributaries—District No. II

Name of Stream and Situation of Power Site	Water-shed in square miles*	Selected head in feet*	Estimated horse-power*	Remarks
Fraser river :				
†229 Cañon between Yale and Lytton§	82,400	150‡	200,000§	River descends about 280 ft. in 53m. Rugged cañon extends for 30m., solid rock walls, in places only 200-300 ft apart. Difficult to develop.
†230 Cañon between Lytton and Lillooet§	60,400	....	....	River flows in deeply eroded trough-like valley many hundred feet below general surface.
231 River above Lillooet to Chimney creek§	46,200	....	....	Trough-like valley continues, height of banks gradually decreasing. Total descent, Chimney creek to Lytton, 800 ft. in 120 m.; not navigable for cañoes ; numerous rapids and cañons.
232 Cottonwood cañon	37,400	20	10,000	River narrows ; water swift and deep ; rock banks rise precipitously up to 200 ft. Single channel navigable by canoe and steamer. Head optional, limited by back flooding. Dam with locks might improve navigation.
233 Fort George cañon	31,350	20	10,000	River 800 ft. wide ; has 5 canoe and 2 steamer channels. Precipitous banks and rock bed. Water broken ; flow swift. Head optional.
234 Rapids and cañon (above mouth of Willow river)	10,400	....	....	Not examined from a water-power standpoint.
TRIBUTARIES TO FRASER RIVER BELOW CONFLUENCE OF THOMPSON RIVER				
Coquitlam river	....	....	....	Dam at outlet of Coquitlam lake diverts its waters to Buntzen lake and thence to Burrard inlet. See District No. IV, Power Site No. 443.
Pitt lake	....	....	....	Pitt lake is tidal. Power possibilities on numerous small tributaries.
Pitt river	260‖	....	....	Rapid in upper reaches, power possibilities said to be relatively small.
Gilley (Munro) **creek** : (trib. to Pitt river)				
†235 Gilley Bros. development	7	600	250	Partial development to operate rock crushers at quarry ; 250 h.p. plant but sometimes insufficient water.
†235 Possible total head	6	2,000	1,500	Descent over 2,000 ft. in 1m.; rapids and falls. Storage in Gilley and Dennett lakes.
Widgeon (Silver Pitt) **creek**: (trib. to Pitt lake)				
†236 Rapid in cañon (4m. from mouth)	25	400	1,800	400 ft. in 7,000 ft. cañon. Coquitlam municipality surveyed creek for water supply. City of Westminster has made application for power rights.
Raven (Rushton) **creek** : (trib. to Pitt lake)				
†237 Cañon 900 ft. from lake	10	650	1,500	Fall of 100 ft. and 550 ft. head in ½m. rapid ; possible to divert water from above falls to lake shore. Small lake for storage 650 ft. above Pitt lake and ½m. distant
Rainbow creek (trib. to Pitt lake):				
†238 Series of falls in cañon	24	630	2,200	630 ft. head in ½m. of falls and rapids, dam-site at head of falls. Easily developed power.
West Lillooet river :				
†239 Original plan of development (diversion into Kanaka creek)	60y	300	10,000[1]	Proposed development which led to famous Burrard Power case. Kanaka creek is small but flows in deep ravine with fall at one point of 100 ft.; good storage in Lillooet lakes.
†239 Second plan of development (by flume)	....	....	....	300 ft. fall in 5½m. rapids and falls. Proposed flume along side hills would be expensive and troublesome in maintenance.
†239 Third plan of development (by tunnel to Stave lake)	....	....	....	Water might be diverted by tunnel to Stave lake, about 100 ft. lower than Lillooet lake, and utilised in the Stave River plants.
North fork West Lillooet river :				
†239 Falls near north bdy. Tp. 12	15	60	150	Series of falls ; total descent about 60 ft. in 600 ft. Suggested development in connection with rock quarry. Proposed domestic supply to Maple Ridge municipality.

* See Description of Power Tables.
† Power sites on streams within the confines of Railway Belt.
‡ Assumed for purposes of estimate.
§ For discussion of power possibilities of Fraser river, see page 231.
‖ Watershed area above Pitt lake.
[1] About the same amount of power is available whichever method of development is adopted, assuming that in each case the total head is utilised.
y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Stave river :				
†240 Western Power Co. of Canada, Upper site	450	120	52,000‡	At Stave falls below outlet of Stave lake (area about 12 sq. m.). Concrete dam 60 ft. high will be raised 20 ft., making area Stave lake about 24 sq. m. Existing plant designed for four 13,000 h.p. units, three now installed.§ Operating under 100 ft. head; ultimate development 120 ft. head.
†240 Lower site	450	120	52,000‡	120 ft. head is available in Stave river between present plant and mouth. Two plans are proposed : (a) One dam in rocky cañon near mouth to develop full head, (b) two dams, each about 65 ft. high, one at mouth of river and the other 1m. below present power house. Latter plan will probably be adopted. (See page 169.)
Silverdale (Silver) **creek:** (below Mission)				
†Development by Mission Water, Light and Power Co.	Small	200	250	Rock-fill crib dam 30 ft. high; 72 ft. storage; 3½m. pipe. 55-k.w. generator installed. Possible total head 230 ft.
Bristo creek (trib. to Sumas lake) :				
†241 Rapids	Small	300	80–100	300 ft. fall in 1m. rapds ; possible dam 25 ft. high would give pondage for 12 hours flow.
Chehalis river :				
†242 Rapids below outlet of lake	86y	400	15,000	300 ft. fall in 8m. rapids ; possible dam 40-60 ft. high, storage in Chehalis lake. Probably expensive development, necessitating long pipe-line.
Slollicum creek : ‖ (trib. to Harrison lake)				
†243 Succession of falls	5	2,800	3,500	Power house site on lake shore. Highest fall 220 ft.; total descent 2,800 ft. in 1m. Two small lakes afford possible storage.
Lillooet river :				
Below Lillooet lake	2,200x	....	....	Descends 640 ft. in 30m. from Lillooet lake to mouth.
Above Lillooet lake	1,600	..	....	Rises in mountainous region, but, near Pemberton meadows, flows sluggishly in tortuous channel; subject to overflow.
Snowcap (Glacier) **creek :** (trib. to Lillooet river)				
244 Fall below Glacier lake	40–50y	....	....	Considerable fall reported between Glacier lake and mouth.
Green river : (trib. to Lillooet river)				
245 Nairn falls, proposed development (5m. from mouth)	180	175	3,200	175 ft. effective head available. Proposed development is below Rutherford and Greta creeks. About 15 ft. storage is said to be available in Green lake by lowering level. Proximity of railway tracks may limit development.
Soo river : (trib. to Green river)				
246 Cañon 2m. from mouth	75	....	....	No particulars re head available. Storage might be developed in series of lakes and large meadows. This would augment flow at Nairn falls (see above).
Pemberton creek : (trib. to Lillooet river)				
247 Suggested development	....	....	950	Development of 950 h.p. suggested; additional power is reported.
Chilliwack river :				
†248 Rapids	450x[4] 150y	250	11,500	2,000 ft. fall between Chilliwack lake (2,600 acres) and Fraser river. Stream bed chiefly composed of large boulders. Several power sites reported but no pronounced falls.[1]
Tamihi creek : (trib. to Chilliwack river)				
†249 Suggested development	....	....	....	
Jones lake : [2]				
†250 Proposed development (on east bank of Fraser river)	25y[3]	1,800	25,000	1,800 ft. in 3m via tunnel 10,000 ft. long. Lake, elevation, 2,060 ft.; area, 1,260 acres; storage, 89,000 acre-ft. Area to 50 ft. contour, 2,300 acres. Boulder creek run-off about ⅓ that of lake; could be diverted into it.

*See Description of Power Tables.

†Power sites on streams within the confines of Railway Belt.

‡Horse-power of complete proposed installation. About 45,000 h.p. is available continuously at each site.

§Third unit was installed in 1916, and intake gate and penstock erected for fourth unit.

‖Slollicum creek is one of the several small creeks tributary to Harrison lake. Many of these are unnamed and nearly all have stretches of rapids, falls and cañons. Details are not available, but probably numerous small powers await development.

[1]Various projects have been proposed for partially developing latent power possibilities, but any development will probably be expensive. The stream is subject to severe freshets and its control is of importance in connection with agricultural lands at its mouth. Two proposals contemplate using heads of 250 and 100 feet, respectively.

[2]This power site has been specially studied. (See page 174.)

[3]Area determined by triangulation survey by Messrs. Anderson & Warden.

[4]About 310 sq. miles in Canada.

x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Watershed in sq. miles	Head in feet	Horse-power	Remarks
Hunter creek:	*	*	*	
(5m. below Hope)				
†251 Fall and rapids near mouth..	11	700	1,000	100 ft. fall and 600 ft. descent in 2m. rapids in rocky cañon, ½m. from mouth. Little if any storage.‡ More fall above.
Silver (Silver-Hope) **creek:**				
(near Hope)				
†252 Rapid near mouth..........	85	900	14,000	1,040 ft. in 5m. rapids, from Silver lake to Fraser; lake area about 300 acres.
Coquihalla river:§				
†253 Rapid and cañon about 5m from mouth — First projected development	260	225	....	Stream descends 3,500 ft. in 33½m. from Summit lake to Hope. Suggested development with 60 ft. dam at head of box rock cañon and 2,600 ft. tunnel.
†253 Alternative scheme.........	260	315	7,500	Similar dam and 3,900 ft. tunnel. No extensive storage except by high and costly dams.
Nicolum river:				
(trib. Coquihalla river)				
†254 Proposed development......	58x	1,800	3,000‖	Proposed to erect two d... and form storage reservoir of 10,000 acre ft. diverting upper part of Sumallow river.[1] Power plant near confluence with Coquihalla. Stated that several times the listed power might be developed.
Emory creek:				
†255 Rapids 2m. above mouth....	10	1,000	900	Stream descends 1,150 ft. in 3m. Proposed to use 1,000 ft. head.
Yale creek:				
†256 Falls in cañon............. (1½m. above mouth)	24	900	2,000	50 ft. direct fall; total 900 ft. in 2m. Can. Pac. Ry. has small dam for water to tank and hotel. Proposed to develop 600 ft head.
Siwash creek:				
†257 Rapids 1m. from mouth.....	Small	1,000	....	Proposed to utilize 1,000 ft. head.
Spuzzum creek:				
†258 Rapids 5m. from mouth.....	65	1,000	6,000	1,200 ft. fall in 5½m. rapids. Proposed development of 1,500 ft. head.
Skuzzy creek:	75x			
†259 Rapids near forks........... (3m. from mouth)	64	1,000	6,000	Reported that 1,000 ft. head might be developed.
Anderson creek:				
(3m. south of North Bend)				
†260 Cañon near mouth..........	180	50	325	50 ft. in 1m. rapids, 1 per cent grade for 3,500 ft. Further up, slope steeper. Said that 1,000 ft. head might be developed.
North Bend creek:				
†261 Development by Can.Pac.Ry.	Small	200	10	Small hydro-electric plant. Creek also supplies Can Pac. Ry. tank and domestic supply. Dam. 20ft. long, 4 ft. high. One 9-h.p. Pelton wheel. Owing to requirements for domestic purposes the water-power plant has been largely superseded by a steam plant
Nahatlatch river:	400x			
†262 Rapids below lakes.........	300y	550	30,000	550 ft. fall in 5m. Dam below outlet of lower lake Storage in chain of 4 lakes. (See page 233.)
Kwoick creek:				
(9m. below Lytton)				
†263 Rapids.....................	13	1,000	2,000	2,000 ft. fall in 6m. Narrow valley, steep rocky side hills, many rock slides. Three small lakes 9m. from mouth Dam-site at head of rapids.

THOMPSON RIVER AND TRIBUTARIES

Stream and Site	Watershed in sq. miles	Head in feet	Horse-power	Remarks
Thompson river:[2]				
†264 Cañon above mouth........	21,500	200[3]	100,000[2]	Descent about 300 ft. in 22m. between Spence Bridge and mouth; rugged cañon.
Rapids above Spence Bridge.	....	....	....	Descent 225 ft. in 25m. between Ashcroft and Spence Bridge; numerous rapids and cañons.
Rapids above Ashcroft......	....	....	....	Descent 200 ft. in 20m. between Kamloops lake and Ashcroft; numerous rapids.
Botanie creek:				
(3m. east of Lytton)				
†265 Rapids.....................	30x	1,000	200[4]	2,700 ft. fall in 9m. Head optional. Botanie lake ½m long, ¼m. wide. Irrigation requirements paramount.

*See Description of Power Tables.
‡Lake shown on this stream on Yale sheet does not exist.
†Power sites on streams within the confines of Railway Belt
§See *Report, Geological Survey of Canada, 1877-1878*, p. 40B.
‖The estimate here given, assumes no diversion of waters that flow south to the Skagit river. The watershed given is that naturally tributary to the Nicolum river.
[1]Such a diversion would, however, affect boundary waters.
[2]Thompson River power will be difficult to develop owing to natural conditions, fishing interests and to railway tracks which parallel river on both banks. (See pages 234 and 235.)
[3]Assumed for purposes of estimate.
[4]Available during irrigation season.
x Drainage area above mouth. y Drainage area above lake outlet.

CAÑON ON WILLOW RIVER
Suggested development for Prince George hydro-electric supply.

NECHAKO RIVER
Grand cañon above outlet from Cheslatta lake.

NECHAKO RIVER
Tetachuck falls, below outlet of Tetachuck lake.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Nicomen river : (9m. above Lytton)	*	*	*	
†266 Cañon ½m. above mouth	43	650	100	650 ft. fall in ½m. Narrow rocky cañon. Above cañon, flat valley and Indian reserve. High dam possible but would flood part of valley.
Murray creek : (1m. below Spence Bridge)				
†267 Clemes power development.. (at mouth)	48	255	160	175 ft. fall in 50 ft. and 25 ft. in 500 ft. rapid ; 255 ft head developed by 12 ft. timber intake dam ; short tunnel with 16 in. stee lpipe 400 ft. long. 176 h.p. Pelton installed, 12-hour power. Creek also supplies Can. Pac. Ry. tank and irrigation. Many small cañons, falls and rapids in upper reaches.
Nicola river.....	2,650	...	....	Descent 1,320 ft. in about 45m. from Nicola lake to mouth. In dry belt ; has very small flow and proximity of railway tracks would make development difficult.
Spius creek : (trib. to Nicola river)				
†268 Rapids....................	280	100	350	100 ft. fall in 2m.; no good storage. Nicola Valley Pine Lumber Co. has a 28-ft. dam about 1m. from mouth; maximum height of dam possibly 50 ft.
Bonaparte river :				
†269 Ashcroft Electric Co. development.................. (Power house 3m. from mouth)	2,000	70	300	Dam in rocky cañon ; washed out in 1913.
Possible development....... (Rapids in cañon near mouth	....	350	1,500	A high dam near present dam and fluming to mouth of river might develop power for pumping for irrigation.
Deadman river :				
†270 Rapid in cañon 4m. from mouth.................	540	40	40	40 ft. fall in ½m. rapid. Irrigation interests are paramount.
271 Snohoosh (Deadman) lake dam..................	230y	20	15	Area of lake 350 acres; dam 20·5 ft. high, 140 ft. long ; 7,000 acre-feet stored for irrigation.‡
Walhachin Irrigation canal .. (near Walhachin)	....	98	....	Small power development could be obtained during irrigation season.
272 Falls in cañon at the bend 30m. above mouth.......	170	170	80	170 ft. sheer drop. Some regulation of flow might be obtained at head-water lakes.
Tranquille river :				
†273 Cañon 3m. from mouth.....	230	....	....	Cañon 100 ft. wide, steep granite banks. Used for irrigation.

SOUTH THOMPSON RIVER AND TRIBUTARIES§

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
South Thompson river:	6,750x	....	....	Navigable from Kamloops to Shuswap lake.
Chase creek :				
†274 Chase falls................. (1½m. above mouth)	100	75	20	Two falls of 34 ft. and 38 ft.; rocky banks. Water supply for irrigation and town of Chase.
Adams river :				
†275 Adams River power site..... (Adams River Lumber Co.)	1,160y	165	25,000 to 30,000	Descent 190 ft. in 6m.; two pronounced drops of 65 ft. each may be combined with rapids between to give 165 ft. head. Good storage in Adamslake, area 54 sq m. Rock-filled timber crib dam at outlet is 180 ft. long, 15 ft. high, with six sluice gates and fish ladder.
Celista creek : (trib. of Shuswap lake)				
†276 Fall and rapid 1m. from mouth..................	150x	200	1,000	200 ft. head in ½m. rapids and falls.‖
Seymour river : (trib. of Shuswap lake)				
†277 West Branch rapids.........	....	....	....	A succession of rapids for many miles ; rocky, boulder-strewn bed ; narrow valley. Storage possibilities in extensive beaver meadows at headwaters.
Salmon river : (trib. Shuswap lake)				
Near junction of North and South forks.............	....	1,200	....	Head of 1,200 ft. reported.
Ingram creek : (trib. Salmon river)				
†278 Suggested development......	28	....	....	Proposed small development, 4,000 ft. south of Kamloops-Vernon road.

*See Description of Power Tables.
†Power sites on streams within the confines of Railway Belt.
‡See also *Water Resources Paper No. 8*, p. 192.
§The mean annual run-off of the North Thompson (watershed area, 7,850 sq. m.) probably exceeds considerably that of the South Thompson (6,760 sq. m.).
‖See *Annual Report, Minister of Lands*, British Columbia, 1913, p. D456.
x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Shuswap (Spallumcheen) **river** :	*	*	*	
†279 Power site 3m. below Mabel lake	1,680	30–40	4,500‡	Total fall, Mabel lake to Mara lake, about 120 ft.; 30 to 40 ft. head might be developed ; good storage available.
280 Shuswap falls (12m. south of Mabel lake)	760	130	12,000§	70 ft. fall in about ½m. rapids in gorge. Head developed by intake dam (90 ft.) backing up water 4m., and 3,750 ft. pipe to power house. Couteau Power Co. proposed development.
281 Sugar Lake outlet	430	70	6,000§	Head developed by 40 ft. dam and 38 ft. fall in 200 ft. rapid below outlet. Couteau Power Co. Fourth development.
Cherry creek : (trib. to Shuswap river)	....	....	....	Said that considerable storage might be developed by high dam.
Fortune (Davis) **creek** :				
†282 Power development (by town of Armstrong)	22	540	150‖	540 ft. head developed by ¾m. pipe line for small lighting plant ; 16 ft. dam 13m. from mouth. One 150-h.p. unit and oil engine auxiliary. Power at 2,200 volts transmitted to Armstrong.
Crazy creek : (trib. to Eagle river)				
†283 Small development	45	150	300	Small Pelton wheel development ; 7 in. wood-stave pipe. Power for saw-mill, fire protection, lighting, and domestic purposes. Steam auxiliary during winter months.

NORTH THOMPSON RIVER AND TRIBUTARIES

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
North Thompson river	7,850x	....	....	Navigable for 90m. upstream from Kamloops and in several stretches above.
284 Hellgate cañon (160m. above mouth)	....	30	1,300	Narrow rock cañon.
284 Total head in about 4m.	1,200	160	7,000	Descent 140 ft. in 4m. from head of cañon to still-water below and a total of 260 ft. in about 8m. Above cañon, fall is about 5-6 ft. per mile.[1]
St. Paul creek : (Reserve creek, Reservation creek, Schiedam creek)				
†285 Rapids 9m. from mouth	59y	400	350[2]	400 ft. in 2m. rapids below proposed dam. Storage in Paul and Pinantan lakes. Below power site water mostly used by Kamloops Indians and Western Canadian Ranching Co. Any power development would be subservient to these irrigation interests ; about 350 h.p. might be developed during season.
Louis creek : (trib. to North Thompson)				
286 Rapid above mouth	200x	200	650	200 ft. in 2m. rapid. For 5m. stream falls 100 ft. per m. Low gravelly banks and bed. Present development, overshot wheel 11·5 ft. diam., 900 ft. flume. Head optional.
Cahilty creek : (trib to Louis creek)				
†287 Rapids and cañon	14x	500	200	400 ft. in 1m. cascades. Above, creek in cañon to lake. Estimated fall 1,000 ft. in 3m. rapids. Storage in Cahilty lake. Head optional.
McGillivray creek : (trib. to Louis creek)				
†288 Rapid ½m. above mouth	12	200 to 1,300	40 to 280	220 ft. in 1,000 ft. rapid, and 1,300 ft. in 2m. in cañon. Head optional. Small turbine being installed. Working head 33 ft.
Barrière river :				
289 Initial development by Kamloops city (5m. above mouth)	350x 135y	190	2,200[3]	190 ft. head developed in 3½m. Flume, 5½ x 8 ft. Two penstocks 490 ft. long. Steam reserve at Kamloops.
289 Second proposed development	....	190	5,000	Same head, with storage in North Barrière lake, elevation 2,100 ft.; area at low water 1,200 ac.; level to be raised 20 ft. giving 30,000 acre-feet storage.
289 Ultimate development	....	600	20,000[3]	Flume and conduit system from North lake with additional storage in East Barrière lake.

*See Description of Power Tables.

†Power sites on streams within the confines of Railway Belt.

‡Assumes the prior development of Shuswap Falls site, and some storage on Mabel lake.

§*Initial development.* One 96-inch pipe, 4,000 continuous h.p. with peak capacity of 7,000 h.p.

Second development. Two 96-inch pipes, 8,000 continuous h.p. with peak capacity of 13,250 h.p. Storage in Sugar lake by dam, raising lake 18 ft. but designed to permit increase to 80 ft.

Third development. Three 96-inch pipes 12,000 continuous h.p. with peak capacity of 19,880 h.p.; additional storage by raising Sugar lake to 40 ft.

Fourth development. Installation of second plant at Sugar lake, increasing total capacity to 18,000 continuous h.p. with peak capacity of 28,880 h.p.

‖In the winter months the natural flow of the stream is little more than sufficient for the domestic supply to Armstrong and an oil engine auxiliary is used. Investigations are being made with a view to increased storage in upper watershed.

[1]Below Hellgate cañon, the North Thompson falls about 25-30 ft. in 14 miles—below this the grade is steeper, the river falling about 200 ft. in 14 miles, and 220 ft. in next 15 miles. See *Altitudes in Canada*, 1915, by James White : pp. 120 and 250.

[2]Available during irrigation season.

[3]Initial installation, 2 units, totalling 2,200 h.p. Ultimate development 15,000 to 20,000 h.p. Power to be distributed along the North Thompson valley to operate irrigation pumps. See page 162.

x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
	*	*	*	
Lemieux creek :				
290 Fall 7m. from mouth	60	70	50	Fall of 70 ft. in cañon. Storage in Taweel lake, elevation 3,800 ft. More head above falls.‡
Nehalliston creek : (trib. Lemieux creek)				
291 Development by Mount Olie Light and Power Co.	95x	50	40	50-ft. head developed by 600 ft. of 16-in. wood stave pipe, to small turbine.§
Dunn creek : (trib. Boulder creek)				
292 Saw-mill plant	Small	....	....	Small saw-mill plant. Storage in Dunn lake.
Clearwater river :‖				
293 Rapids	1,830[1]	40	6,000[2]	Reported fall of 500-600 ft. in first 25m. above mouth and to be a succession of falls and rapids with a series of rocky cañons for a large part of this distance. Storage in Clearwater lake.
294 Falls at foot of Lower Clearwater lake	1,050	20	2,000	10 ft. straight fall and 10 ft. in 150 ft. rapids. Storage in several lakes. Watershed mountainous; many glaciers exist.
Candle creek : (trib. to Clearwater 5m. from mouth)				
295 Rapids near mouth	Small	800	30	About 800-900 ft. fall in 1m.
Bear creek : (trib. to Clearwater 8m. from mouth)				
296 Falls and rapids near mouth	....	800	250	Series of falls 50-100 ft. high and rapids. Total of 800 ft. in about 1m. above mouth.
Beaver creek : (trib. to Clearwater 15m. from mouth)				
297 Falls and rapids near mouth	....	750	250	750 ft. in series of falls and rapids in ½m. above mouth.
Bridge creek : (trib. to Clearwater)				
298 Fall 2m. below Mahood lake	1,800y	60	400	River flows in deep gorge or cañon 4m. long with a direct fall of about 60 ft. 2m. below lake.[3]
299 Fall 1m. below Canim lake	....	110	600	Direct fall 75-110 ft. Storage in Canim lake.
299 Total between lakes	1,480y	476	2,500	Falls 476 ft. in 5m. cañon between Canim and Mahood lakes.[4]
Murtle river :[5] (trib. to Clearwater)				
300 Helmcken falls (1m. from mouth)	400y	700	20,000	450 ft. fall (in lot 3,210) with 250 ft. head in rapid and falls below. Low banks above falls, cañon-like below.
300 Dawson falls (3½m. above mouth.)	....	110	3,000	Three 20-ft. falls and one 50-ft. fall (in lot 3,208).
301 Fall 10m. from mouth	....	25	700	Fall of about 25 ft. (in lot 3,494).
301 Horseshoe falls (12m. from mouth)	....	35	950	Fall of about 35 ft. (in lot 3,499).
301 Meadow fall (13m. from mouth)	....	20	550	Fall of about 20 ft. (in lot 3,998).
302 Falls, 1m. or 2m. below Murtle lake	400y	40	1,100	Said to be fall of about 40 ft. Storage in Murtle lake (area, about 15 sq. m.) and in smaller lakes above.
Upper Clearwater river :				
303 Rapids and falls between lakes	300	300[6]	6,000	About 600 ft. fall[7] in 7m. between Upper Clearwater (about 20 sq. m. in area) and Clearwater lakes, partly in cañon. Several falls of 30-40 ft. or more; grade is steepest above outlet of Blue lake. Drains high glacier-clad mountains.
Raft river :[8] (trib. North Thompson)				
304 Rapids and falls	125x	60	150	Series of falls in cañon ½m. from mouth, two lower 15 ft., upper one 25 ft. No information available re upper section of river.

*See Description of Power Tables.
‡See *Water Resources Paper No. 14*, p. 40.
§See *Annual Report of Minister of Lands*, British Columbia, 1913, p. 452.
‖This watershed merits fuller investigation.
[1]Watershed area given is total above confluence of, and including, drainage area of Murtle river. Total drainage area of Clearwater is about 4,150 sq. m.
[2]The h.p. here given is based on utilisation of about 40 ft. head with some storage; it does not represent the ultimate power possibilities of river.
[3]See *Report, Canadian Pacific Railway*, 1874, p. 127; also *Altitudes in Canada*, 1915, by James White, p. 129.
[4]See *Annual Report, Minister of Lands*, British Columbia 1912, p. D266, and for 1913, p. D322. Altitude of Canim lake is 2,557 ft. and of Mahood lake 2,081 ft.
[5]See *Water Resources Paper No. 14*, p. 257. Horse-power estimates for the Murtle river are based on an assumed flow of about 300 sec.-ft. It is believed this is a conservative estimate of the flow that might be maintained by a partial use of the storage available.
[6]Assumed for purposes of estimate.
[7]Probably this estimate of fall is too large. See *Water Resources Paper No. 14*, p. 217.
[8]See *Water Resources Paper No. 14*, p. 260.
x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Mud river : (95m. from Kamloops)	*	*	*	
305 Fall and rapid near mouth	45x	60	100	Fall of 30 ft., 30-ft. head in 300 ft. rapid. Rock banks; stream falls about 50 ft. per mile.
Tumtum creek : (112m. from Kamloops)				
306 Fall ½m. from mouth	....	500	....	500 ft. fall.
Mud creek (mile 142) :				
307 Falls	....	....	....	Falls reported about 3m. above Mud lake.
Hell-roaring creek (mile 152) :				
308 Fall ½m. above mouth	....	200	....	Direct fall of 200 ft.
Thunder creek (mile 153) :				
309 Falls	....	....	....	Falls reported but situation not ascertained.
Bone creek (mile 156) :				
310 Falls	....	....	....	Falls reported but situation not ascertained.
Pyramid creek (mile 162) :				
311 Falls	....	200	....	Falls reported, about 200 ft. head, near mouth.
TRIBUTARIES TO FRASER RIVER ABOVE CONFLUENCE OF THOMPSON RIVER				
Stein creek (near Lytton) :				
†312 Rapids	112	500	5,000	Rapid stream ; many cañons, falls and rapids ; descends 1,500 ft. in 9m. Head optional. Small lake on tributary.‡
Texas creek :				
313 Falls and rapids 1½m. from mouth	80	1,000	5,000	Proposed to utilise 1,000 ft. head on this stream.
Cayuse river :				
314 Falls south of Lot 2,686 (near mouth)	340	....	....	Proposed to develop power on this stream. Steep grade in places ; large fall near mouth.§
Seton creek :				
315 Outlet of Seton lake	600	....	....	Descends about 50 ft. in 1½m. to Cayuse creek.‖ Creek important in connection with proposed diversion of Bridge river to Seton lake.
Portage creek :				
316 Rapids	390y	70	2,000	Portage creek joins Anderson and Seton lakes ; total descent 70 ft. in 1½m.[1]
Connel (Roaring) **creek** : (trib. to Anderson lake)				
317 Fall	15	....	150	Said to be high fall and some power possibilities.
McGillivray creek : (trib. Anderson lake)				
318 Saw Mill	30	160–200	500	100 ft. direct fall near lake, partially developed for small saw-mill.[1]
Dickie creek :				
319 Proposed diversion 1m. from mouth	Small	....	....	Proposed development.
Bridge river :				
320 Proposed diversion to Seton lake	2,540x 1,940	1,150	63,000[2]	Proposed development by Bridge River Power Co. by tunnel 2¾m. through mountain from head of cañon to above Seton lake. Limited storage possible by high dam in cañon below point of diversion. Valley above cañon is flat.
Upper Bridge river :				
321 Falls on main stream above Hurley river				
Lower falls (1m. above confluence)	....	70a	....	70 ft. fall. Width of stream 100 ft. ; rocky knoll on right bank, 40 ft. high ; left bank below crest of falls. 30 ft higher than crest.
Upper falls (1¾m. above confluence)	....	30b	....	30 ft. in 200 ft. cascades, rocky points rise 10-30 ft. above crest.
Total in about ¾m	400[3]	100	2,000	Possibly *a* and *b* might be combined for 100-ft. head. Wide, fairly flat valley above. Glacial-fed stream.

*See Description of Power Tables.
†Power sites on streams within the confines of Railway Belt.
‡See *Water Resources Paper No. 8*, p. 272.
§See *Water Resources Paper No. 14*, p. 172.
‖See *Water Resources Paper No. 14*, p. 193 ; also *Altitudes in Canada*, by James White, 2nd Edition, p. 198, which gives elevation above mean sea level of Anderson lake as 850 to 846 ft., of Seton lake 777 ft., and of Cayuse creek 757 to 751 ft. A fall of 20-26 ft. in Seton creek and 69-74 ft. in Portage creek.
[1]See *Annual Report, Minister of Lands*, British Columbia, 1913, p. D461.
[2] 24-hour h.p. with low-water flow of about 650 sec.-ft. Development of storage reservoirs reported on upper waters may permit ultimate installation of 100,000 to 200,000 h.p. See page 171.
[3]Not well defined on maps ; estimated to be between 350 and 450 sq. m.
x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Alexander creek : (trib. to Bridge river)	*	*	*	
322 Alexander Mines development	....	500	2,000‡	300 ft. head developed for mining purposes by flume and ditch. Water for 6 months for two 7-inch monitors. Gravel banks. Small glacial-fed stream, never goes dry.
Gun creek :				
323 Rapids	350x	...	3,000§	Good small-power possibilities reported.
Gun lake :				
324 Development proposed by Wayside Mining Co.	27y	800	2,000	Lake is 800 ft. above Bridge river, total head obtainable at small cost ; discharge small ; fed by glaciers ; storage in lake.
Hurley (Hamilton) **river :** (South fork Bridge river)				
325 Rapids	350x	....	3,000§	Good small-power possibilities reported.
Cadwallader creek : (trib. Hurley river)				
326 Development by Coronation Mines	125x	....	....	Small mining development
Chilcotin river :	7,120x			
327 First cañon (7m. from mouth)	7,090	50	6,000	30-ft. fall in 800 ft. rapid. Precipitous rocky cañon ; walls 80 ft. high ; width at narrowest portion 45 ft. ; rock channel 800 ft. long; possible 20 ft. dam at upper end. Storage in Chilko and Tatla lakes.
328 Second cañon (1m. east of Hanceville)	6,250	12	1,300	4-ft. fall in 600 ft. rapid. Power site may be created by 10-ft. dam at upper end of cañon. One side of cañon has exposed rock wall ; river channel 200 ft. wide ; cañon is 900 ft wide. Storage in Chilko and Tatla lakes.
Chilko river :				
329 Cañon between mouth and Taseko river	3,000	40	4,000	10-ft. fall in 2,500-ft. rapid ; width of cañon at dam-site, 78 ft. ; at narrowest point, [illegible] ft. Perpendicular rock walls 60 ft. high, affording site for dam of 30 ft.
Big creek : (trib. to Chilcotin)				
330 Cañon and falls	640x	100‖	800	Said to have numerous falls and rapids in first 6m. above mouth. Flows through cañon with perpendicular rock walls 100-600 ft. high.[1]
San Jose river :				
331 Falls (12m. below lac la Hache)	380y	150	100	Direct fall 10 ft. Storage in lac la Hache, but level of lake could not be raised much. Total descent from Murphy meadows said to be 150 ft. in 1½m.
Baker creek : (near Quesnel)				
332 First cañon (2½m. from mouth)	470	50	50	55 ft. fall in 1m. rapids ; 10-ft. dam might be erected ; rock banks. Storage in two lakes at headwaters.
332 Second cañon rapids	....	....	50	Small power about 10m. from mouth ; head optional.
Quesnel river :	4,525x			
333 Rapids in rock cañon (about 21m. from mouth)	4,350	30–50	10,000[2]	7 ft. fall in 2,000 ft. rapids. Precipitous rocky banks rising over 100 ft.; river at narrowest point about 100 ft. wide. Excellent site for dam 30-40 ft. high.
South fork, Quesnel river :				
334 Dam-site, foot first cañon	....	*a*	....	See Item *b*.
334 Dam-site, foot second cañon	....	*b*	....	120 ft. fall in 3m. rapids to foot of first cañon, 30 ft. dam would give small pondage. Precipitous rock banks 300 ft. high. See Item *c*.
334 Rapids from Quesnel lake to Quesnel Forks	2,550y	235*c*	90,000	235 ft. in 7m. rapids. Site for dam 20-30 ft. about 1m. below Quesnel lake, just above settlement at present dam; would raise Quesnel lake 10-20 ft. Includes *a* and *b*.
North fork, Quesnel river :				
335 Keithley falls (2m. below Cariboo lake)	880y	75	3,000	Fall 12 ft. ; 30 ft. fall in 900 ft. rapids above ; 15 ft. in ½m. rapids below. Good dam-site above falls. A dam might control Cariboo lake for storage. Width of river above falls 100-150 ft. Several rapids below falls ; about 30-ft. head might be added per mile of flume for some miles. Elevation of watershed 2,500 to 8,500 ft. Upper waters fed by numerous glaciers.
Horsefly river :				
336 Black Creek falls (4m. above Black creek)	430	160	600	150 ft. head in 2,500 ft. rapids, including direct fall of 40 ft. ; rock cañon ½m.; banks 50-110 ft.; site for high dam above falls.
336 Second falls in cañon (40m east of Harpers camp)	220	100	300	100 ft. in ½m. in cañon, three marked drops. River said to drop 60 ft. per m. for 20m. above falls.
336 North Fork falls	85x	90	150	80-90 ft. fall in ½m. rapid. Small creek ; little information available.

*See Description of Power Tables.
‡Available for 6-8 months of year.
§Rough estimates.
‖Assumed for purposes of estimate.
[1]See *Annual Report of Minister of Lands*, British Columbia, 1913, p. D475.
[2]This estimate assumes partial regulation of the outflow from Quesnel lake.
x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Niagara river : (trib. Quesnel lake 5m. from head)	*	*	*	
337 First fall, near mouth	250	250	1,500	100 ft. direct fall, 150 ft. in 1,500 ft. rapid above. High rocky banks ; stream 75 ft. wide at narrowest point just above falls.
338 Second falls (10m. above mouth)	180	120	500	100 ft. direct fall, 45 ft. in 1m. rapid above. High, rocky banks and good dam-site.
Swamp river :				
339 Falls below Sandy lake	390	50	1,000	Direct fall 50-60 ft. Possible storage in 20 sq. m. of lakes, 3,000 ft. elevation. Mountains rise from water's edge to 8,500 ft. ; numerous glaciers.
Cottonwood river :				
340 First rapid below highway bridge	450	15	100	5-ft. fall in 600 ft. rapid ; dam-site just below Horseshoe bend ; rock banks 30 ft. high. Head limited by flooding valley above.
340 Rock bend (1½m. above Boyd's hay field)	450	10	60	5-ft. fall in 500 ft. rapid. Rock outcroppings 35 ft. high ; possible dam-site. Grade of river here at rate of 50 ft. per mile.
Swift river :‡				
341 High falls (17m. above Cottonwood)	....	....	....	Said to be direct fall of considerable height, not examined.
Blackwater river :				
342 First cañon (4m. above mouth)	4,900	....	....	Has not been investigated, but should be, preferably from lower end.
343 Deep cañon (3-5m. below Blackwater bridge)	4,830	30	200	Cañon between 2m. and 3m. long ; banks hard, rock-like material almost sheer in places, 200 ft. high. Some dam-sites, best one probably at lower end of cañon. Water might be backed up to meadow 1½m. below bridge.
344 Third cañon (200 yds. below Blackwater bridge)	4,680	35	200	9-ft. fall in 500 ft. rapids. Good dam-site in cañon. High freshets raise water 3 ft. above cañon at bridge ; this corresponds to head of 35 ft. above low-water level at third cañon. Dam might be built up to 100 ft., but height would depend upon amount of flooding possible for Blackwater valley.
345 Rapids in Telegraph range (2m. below Batnun creek)	4,550	20	150	9 ft. in 900 ft. rapids. Dam-site below pool below rapids. Possible 20 ft. dam. River might be backed up to Batnun creek.
Euchiniko river :§				
346 Cascades at foot of Kluscoil (Chine) lake	1,200	35	1[illegible]	22 ft. fall in 300 ft. cascades, 13 ft. in ½m. rapids below. Dam might control lake to 3 ft. to 4 ft. above low water Few feet additional head might be obtained by fluming across river bend. Banks and bed hard red sandstone.
347 Fall (1½m. below Kuskya river)	830	40	120	16 ft. direct fall, 6 ft. in 150 ft. rapids above, 17 ft. in ½m. below ; more rapids above but banks are low ; possible storage in Tsacha (Long) lake.
Nazko river : (trib. to Blackwater)				
348 Rapids just above Clisbako	800‖	10	15–20	10 ft. fall in 300 ft. ; rocky banks, high on east ; rocky boulder bed.
Clisbako river : (trib. to Nazko)				
349 Rapids above mouth	350x	15	15–20	12 ft. fall in ½m. cañon; steep banks; probably more falls higher up.
Coglistiko river : (trib. to Baezaeko river)				
350 Rapids	350x	....	....	Rapid mountain stream. Small powers might be developed at some sites.
Small tributaries :				
351 From Ilgachuz and Itcha mountains	Small	....	....	Two or three rapid mountain streams ; might afford small powers for some months of year.
Batnun river :[1] (trib. to Blackwater)	650x	....	....	Series of lakes ; small stream ; no power possibilities.
Hixon creek : (trib. to Fraser 35m. below Prince George)				
352 Suggested development	....	....	....	850 h.p. said to be available at certain seasons.

*See Description of Power Tables.

‡The upper waters of Swift river have been utilised by the Quesnel Hydraulic Gold Mining Co. The water is diverted by means of a dam 600 ft. long and 35 ft. high and conveyed (in a ditch 19 miles long, several siphons of 60-inch diam., wood-stave pipe aggregating about 10,000 feet, some fluming and 6,500 feet of steel pipe) to the gravel deposits near the junction of Birrell creek and Quesnel river. Cost of undertaking about $1,000,000. See *Annual Reports of Minister of Mines*, British Columbia, for 1910 and 1911.

§Main stream of Blackwater and more commonly referred to as Blackwater.

‖Watershed area estimated to be between 500 and 900 sq. miles.

[1]Formerly known as Euchiniko.

x Drainage area above mouth.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Nechako river :				
Rapids on lower Nechako....	17,900x	....	....	Navigable, at certain stages, from mouth to near Fort Fraser; several rapids; stated that low heads might be developed at some sites
353 Dam-site 1m. below Fraser lake....................	8,860	8	3,000†	Dam-site, rock islet in centre ; dam 7-8 ft. would afford storage in Fraser lake ; raise level to high-water mark, and improve navigation from Fraser lake, through the short connecting stream and for some distance up the Nechako river.
Chilako river....................	1,400x	....	....	Small flow at low water, sluggish course through flat valley.
Tachintelachuck creek : (outlet of Bednesti lake)				
354 Rapids....................	Small	....	....	Small creek ; descent 300-500 ft. in 12 or 13 miles.
Stuart river :				
355 First Chinlak rapids§.......	5,600	25a	2,500	9 ft. fall in 600 ft. rapid. At dam-site, rocky reef extends across river with only one boat channel. Precipitous rock banks 30-40 ft. high. Island in mid-stream at entrance to cañon, flow straight, width 350 ft.
355 Second Chinlak rapids...... (4m. above mouth)	5,600	20b	....	4 ft. fall in 1,500 ft. rapid ; swift river about 600 ft. wide ; banks of brown conglomerate, slope back to height of 50-60 ft. ; *b* included in *a*.
356 Third rapids.............. (2m. below Stuart lake)	5,000y	15	1,500	3 ft. fall in 1,000 ft. rapid. Short rock cañon 200 ft. wide ; small rock island in centre ; good rock outcrops up to 30 ft. Probably dam here would control lake level.
356 Fourth rapids.............. (1m. below lake)	5,000y	....	....	Good site for regulating dam, 1½m. below fort St. James. Lake might be raised 3-4 ft. River 300 ft. wide ; small rapid ; rock outcroppings on either side ; rock islet in centre, covered at high water.
Pinchi creek : (trib. Stuart lake)				
357 Falls ½m. from mouth and 2m. below lake..............	420y	80	300	Direct falls of 18 ft. Pinchi lake reported to be about 100 ft. above Stuart lake.
Tatchi river :				
358 Cañon riffle, 4m. below Trembleur lake..............	3,200	6–8	250	6-8 ft. fall reported in 100 ft. rapid ; cañon width, 90 ft.
Young creek : (trib. Tatla lake)				
359 Falls and rapids in cañon.... (8m. above mouth)	....	65	50	Direct fall 15 ft. ; descent 20 ft. in ½m. rapids above, 30 ft. in ½m. below falls. Rocky banks 40 ft. high above crest of falls ; cañon 50 ft. wide. Storage in several lakes at head.
Sinkut creek :				
360 Falls on West branch, ½m. south of forks............	35	90	10	Two falls about 40 and 50 ft. less than ½m. apart. Situated 8m. south of Sinkut lake. Small creek.‡
Stoney creek : (trib. to Nechako river)				
361 Falls 2m. below T[illegible]lake.	160	100	50	Three falls, 24 ft., 21 ft. and 13 ft. Width of small creek at crest of falls 4-5 ft. Difficult to regulate discharge from Tachick lake. Fall in 1m. about 100 ft.
Stellako river : (outlet François lake)				
362 Cañon for 3 or 4m..........	1,600	140a	3,800‖	130-150 ft. fall in about 4m. rapids. François to Fraser lake should be treated as one power site ; control of lake by dam near outlet. François lake, over 60m. long, would provide excellent storage. Power site below small fall.
Upper Nechako river :				
363 Cañons below Cheslatta river	5,700	35 [1]	10,000 [2]	4 or 5 cañons with dam-sites. First, about 20m. above Fort Fraser, last about ½m. below Cheslatta river. Broken water in several places but possible to ascend in canoe at certain stages.
364 Grand cañon.............. (commencing ½m. above Cheslatta river)	5,060	100 [1]	30,000 [2]	25 ft. fall in first ½m. from mouth. Cañon has precipitous rock walls. Total head not ascertained, probably exceeds 100 ft. High dam might be built at outlet. Cañon said to be 5-8m. long with numerous rapids and falls.[3]

*See Description of Power Tables.

†This estimate assumes the development of storage in upper waters, also on Fraser lake, level of which might be controlled from this dam site. The proximity of G.T.P.Ry. tracks might limit development.

§All rapids on Stuart river can be run in dug-out canoe.

‡See *Annual Report, Minister of Lands*, British Columbia, 1913, p. D329

‖This estimate assumes the utilisation of storage on François lake.

[1]Assumed for purposes of estimate.

[2]These estimates assume the utilization, to some extent, of the storage possibilities of the lakes above.

[3]Reported that salmon do not pass through this cañon.

x Drainage area above mouth. y Drainage area above lake outlet.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—Continued

Stream and Site	Watershed in sq. miles	Head in feet	Horsepower	Remarks
	*	*	*	
Cheslatta river:				
365 Double fall	620	130	150	130 ft. in about 1m. Two direct falls of 30 ft.; 15 ft. in 150 ft. rapids below, remainder in rapids above. Easily developed power. Discharge small but good control for storage in Cheslatta and Murray lakes.
Tetachuck river: (falls below Tetachuck lake)				
366 Rapid below fall	....	10a	....	10 ft. fall in ½m. rapid.
366 Fall	....	25b	....	14 ft. direct fall and 11 ft. in cascade above.
366 First rapid above	....	16c	....	16 ft. fall in 900 ft. rapid.
366 Second rapid	....	16d	....	16 ft. fall in 600 ft. rapid.
366 Third rapid	....	25e	....	25 ft. fall in ½m. rapid.
366 Fourth rapid	....	22f	....	22 ft. fall in ½m. rapid.
366 Total in about 3m.	1,780	125	30,000‡	Total fall 125 ft. in about 3m. of falls and rapids below Tetachuck lake (including a to f). Should be treated as one power possibility. Good storage in Tetachuck lake and in large lakes above.
Entiako river	710x	....	....	Small mountain stream in deep cañon for 10m.; small power possibilities.
Endako river	730x	....	....	No power possibilities.
Salmon river (trib. Fraser, 15m. above Prince George)	1,900x	....	....	Not yet reported on.
Willow river:				
367 Lower cañon (Just north of Lot 2,737)	1,100	10	300	7 ft. fall in 1,000 ft. On east side, rock outcrops to height of 15ft.; on west side to 25 ft. Dam would be 80 ft. long with doubtful end protection on east bank. No storage, river bed 40 ft. wide.
368 Main cañon (25m. from mouth)	....	150a	....	150 ft. in 1½m. rapids; precipitous rocky banks, 180-200 ft. high; river at narrowest point about 60 ft. wide.
368 Site near Lot 2,790	....	26b	....	26 ft. in 3,000 ft. rapids
368 Total in 1½m.	980	180	5,000	Good dam-site in upper part of cañon. Total head in 1½m. with flume and pipe-line, 180 ft.: includes a and b. Head might be increased to 220 ft. by 40 ft. dam. Small storage only.§
Bowron (Bear) **river:**	1,430x			
369 Boat cañon‖ (7m. below Purden creek)	1,320	50	2,000	Storage in Purden lake and in lakes at headwaters as given below. Valley is deep and narrow at source; 6 to 8m. wide in lower reaches.
370 Portage cañon‖ (5m. below Purden creek)	1,310	50	2,000	
371 Basket cañon‖ (4m. below Purden creek)	1,300	50	2,000	
372 Bear cañon‖ (2m. below Purden creek)	1,285	50	2,000	Total length of rapid about 1½m. No direct fall.
373 Rapids and cañon (below Indianpoint creek)[1]	590	100	2,500	About 200 ft. fall in 9m. rapids, high banks at head; flows between steep mountain slopes. Head optional Storage in Bowron,[2] Indianpoint and Spectacle lakes.
Fraser river:				
374 Fall and rapid	690	200[3]	3,500	Direct fall 14 ft.; total 200 ft. in short steep rapids, commencing near N.E. cor. lot 5,680 and ending about 1m. east of S.E. cor. lot 886.
375 Rapids	480	500[4]	6,500	8m. of almost continuous rapids from centre of lot 5,665 to S.W. cor. lot 5,667.
McGregor river:				
376 Fall 35m. above mouth	2,400x	100[5]	3,000	Fall 80 ft. high reported.
Ptarmigan creek:				
377 Falls 2½m. from Fraser	75	250[5]	500	
Castle creek: (Mile 84)				
378 Rapid in box cañon (2m. from Eddy)	75	80	150	Box cañon; rapid mountain stream.

*See Description of Power Tables.

‡Assumes the development, to some extent, of the storage sites available.

§It is said that Stony lake could not profitably be dammed to provide storage.

‖The heads given are from a report by a surveyor and total 200 ft. in 5 or 6m. Probably this is a fair estimate of the total head available, though a detailed survey of the river might indicate a different distribution between the various dam-sites of the total fall in the rapids.

[1] The grade of the river is here about 20-30 ft. per mile and there are no pronounced falls. The head would depend upon the height of any proposed dam.

[2] A good dam-site is reported at the outlet of Bowron lake. As Spectacle lake is at practically same elevation as Bowron, it would provide storage on both lakes. Isaac lake discharges south to Swamp river. There is a summit between Indianpoint lake and Isaac lake. A small stream from the south flows partly to Isaac and partly to Indianpoint lakes. The grade of the joining stream is not known, nor the difference in level between the lakes.

[3] Rough estimate of head available.

[4] Estimated with rough check aneroid. See also *Altitudes in Canada*, by James White, 2nd, edition, pp. 187, 249 and 552

[5] Assumed for purposes of estimate.

x Drainage area above mouth.

ELK FALL, CAMPBELL RIVER, VANCOUVER ISLAND

LADY FALL
South fork of Elk river, Strathcona park, Vancouver Island

BIG FALL, UPPER NIMPKISH RIVER, VANCOUVER ISLAND
A drop of 9 feet, the highest individual fall on this river below Vernon lake.

FRASER RIVER AND TRIBUTARIES—DISTRICT No. II—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Holmes (Beaver) **river :**				
379 Rapid 3m. from mouth......	250x	50	350	Rapid mountain stream ; 50 ft. head in cañon.
Raush river :				
380 Rapid 3m. from mouth......	120	75	250	75 ft. head in rapid.
Swift Current creek :				
381 Rapids near mouth.........	70	300§	550	Steep rapid stream, head optional.
Grand Fork river :				
382 Emperor falls..............	75x	200	500	Direct fall of 200 ft.‡
Moose river :				
383 Rainbow Cañon falls........ (100 yds. above railway)	175x	150	1,000	Three cascades, highest fall 50 ft. Suggested development.

*See Description of Power Tables.
‡See *Annual Report, Minister of Lands*, British Columbia, 1913, p. D431.
§Rough estimate of head available.
x Drainage area above mouth.

CHAPTER XII

Vancouver Island—Topography and Power Site Tables

VANCOUVER island, together with Queen Charlotte islands, constitutes the unsubmerged portions of the most westerly of the mountain ranges of British Columbia. Beyond these islands a relatively narrow submarine plateau extends to the continental shelf, and then slopes very rapidly down to the great depths of the Pacific.

Vancouver island is about 285 miles long, with an average width of about 60 miles. The most settled portions are the extreme south and the eastern coast from Victoria to, say, Comox. This portion of the island also enjoys the best climate. The amount and distribution of precipitation varies from 30 inches annually at Victoria, to about 45 inches at Campbell river, and renders irrigation, generally speaking, unnecessary. The summers are usually dry, with ample sunshine. The winters are not severe and have frequent periods of bright, sunshiny weather. The climate of this portion of British Columbia may be likened to that of the south coast of England. The whole of the western coast and most of the interior of Vancouver island are regions of very heavy precipitation, probably averaging, over the greater part, upwards of 100 inches annually. The island is, for the most part, covered with a dense growth of large timber, while the undergrowth is the densest in the whole of Canada, and, in the summer, tropic-like in its abundance. (See Plate 9.)

The coast of Vancouver island is deeply indented with bays and arms of the sea, forming numerous deep-water harbours, thereby providing excellent shipping facilities for the mines, lumber mills, and other industries. Numerous lakes in the interior will provide local transportation routes for short distances, but the streams, for the most part, are not navigable save, to a limited extent, by canoe. The country on the southern and eastern coasts is comparatively level, while the interior is broken by mountains and heavily-wooded valleys. Much of the interior still remains practically unexplored. The greater portion of the agricultural land is covered with large trees and thick underbrush—but the quality of the soil well repays clearing where the timber is not too heavy, and where it may profitably be marketed.

Reference to Vancouver island would be incomplete without mention of the extensive coal areas, the development of which has been such a prominent factor in the history of the province.*

Relatively to area, Vancouver island is exceptionally well supplied with water-power. Thus far, developments have been confined to the smaller streams. The Jordan River plant is an illustration of the way in which, by judicious construction of storage reservoirs, a stream may be made to yield

*For information relating to coal mining in the province, consult the *Annual Reports of the Minister of Mines*, British Columbia; also, *Annual Reports of the Geological Survey of Canada*.

more power than would, at first sight, appear possible. Undoubtedly the largest and best water-power on the island is that on the Campbell river. (See Plate 28.)

It is interesting to contrast the power features of the Campbell river with the Nimpkish. In some respects the rivers are similar ; their total length is about the same and the areas of their respective watersheds, as deduced from the latest maps, are each a little more than 600 square miles. It is probable, also, that the average precipitation over their watersheds is not very dissimilar ; for, although it may be less at the mouth of the Campbell than at that of the Nimpkish, yet the headwaters of the former, owing to the greater average elevation of the watershed, probably have a slightly greater precipitation than those of the Nimpkish. Between Buttle lake and the sea the Campbell falls about 625 feet, but its fall is concentrated in the last few miles of its course, the difference of elevation be[illegible] Lower Campbell lake and tidewater being about 540 feet, of which pro[illegible] 450 feet can be developed at one point. Moreover, this fall takes place [illegible] three large lakes, each of which could be controlled to form storage reservoirs. Contrasted with these conditions, the fall of about 600 feet on the Nimpkish river, between Vernon and Nimpkish lakes, occurs in over 200 small rapids and two falls of 9 and 6 feet, respectively, and it is probable that, at no point, could a head of more than 40 to 50 feet be profitably developed. Again, there is very little storage possible on Nimpkish river, because both Woss and Vernon lakes are small, with low-lying land a[illegible] their outlets. Nimpkish lake will provide some storage but, as its elevation above sea level is only about 30 feet, the power developed cannot be large. (See Plate 28; also views 8 and 9 on Plate 18, which show typical rapids on the Nimpkish river.)

Next to the Campbell river, the most extensive power possibilities on the island are probably those on the watersheds of Somas and Sproat rivers and their tributaries. Another district with power possibilities is that in the vicinity of the head of Quatsino sound, although here the watersheds drained are comparatively small. Details of the various power sites on the island, so far as known, are given in the tables. Water-power developments will be benefited by the fact that little or no provision has to be made to cope with ice conditions ; on the other hand, owing to the very thick undergrowth, the cost of making roads and clearing ground for power houses, reservoirs, and rights-of-way for transmission lines will make developments of the more remote power sites comparatively expensive.

Vancouver Island—District No. III

EAST COAST OF VANCOUVER ISLAND

Name of Stream and Situation of Power Site	Area of watershed in square miles*	Selected head in feet*	Estimated Horsepower*	Remarks
Goldstream river :				
384 B.C. Electric Railway Co. development (12m. from Victoria)	24x 8y	650	3,000‡	First development on Vancouver island, 1898. Two 350-k.w., one 500-k.w., one 1,000-k.w. generators; total 2,200 k.w. Pipe-line 4,000 ft. of 33 in. H.T. transmission 17,500 volts. Storage in Esquimalt waterworks reservoir. (See Jordan river.)
Lakes in Highland district :				
385 Proposed development	Small	....	....	Proposed development by Vancouver Island Power Co. Dam 12 ft. high; 4 sec.-ft. applied for; head not stated.
Trip creek : (Malahat district) Suggested development	Small	....	....	Proposed development by Vancouver Island Power Co. Dam 6 ft. high; 50 sec.-ft. applied for; head not stated.
Shawnigan creek	43x 22y	....	....	Descent about 380 ft. in 4 m. from Shawnigan lake, area 3 sq. m. Creek sometimes dry in July and August. Railways follow both shores of lake.
Koksilah river	112	....	....	Mountain stream, with no natural storage and very irregular flow.
Cowichan river :§				
386 Skutz falls, 11m. above Duncan	325x 270	22	700	Falls of 8 to 10 ft. Proposed to develop head of 22 ft. by 12-ft. dam and rock-cut channel. About 550 ft. fall in 22m. between Cowichan lake and sea. (See below.)
386 Possible total head	225y	100	8,000	Cowichan lake, area 24 sq. m., might be regulated to high water for storage. Power and light for city of Duncan. (Project abandoned owing to local opposition.)
386 Lamereaux falls	....	....	....	Reported falls, particulars unknown.
Holt creek : ‖ (trib. Cowichan river)				
387 Suggested development	11x	....	....	Reported over 300 h.p. might be developed. Cost of creating necessary storage might be high.
Sutton creek : (trib. Cowichan lake)				
388 Suggested development	17x	....	....	Suggested development by Duncan Power and Development Co.
Chemainus river	125x	....	....	Rises in mountains north of Cowichan lake at altitude of 4,000-5,000 ft. No large lakes in watershed and stream is flashy, with low flow in summer. Discharge varies from about 15 to over 5,000 sec.-ft.
Nanaimo river : [1]				
389 Cassidy cañon to Wellington Collieries bridge	245	110	2,500	Cañon and rapids; dam-site at head of cañon.
389 Wellington Collieries bridge to South Fork Road bridge	....	230	4,500	230 ft. fall in about 5m. rapids; no pronounced falls.
389 South Fork Road bridge to Jump creek	210[2]	150	3,000	150 ft. fall in about 4m. rapids.
389 Jump creek storage dam site	115[3]	80	1,500	80 ft. fall in about 4m. rapids. Storage in two lakes, area about 2 sq. m., elevation 700 ft.
Millstone river : (near Newcastle)				
390 Nanaimo Elec. Light, Power and Heat Co.	Small	177	200	160 ft. fall in 1m. rapid near mouth. Diversion dam at Newcastle reservoir, area 200 acres, on unnamed tributary. One 450-h.p. Pelton. Steam auxiliary.

*See Description of Power Tables.
‡Approximate total h.p. of turbines installed.
§There is a Government fish hatchery on Cowichan river near Cowichan lake, and, at present, the river is reserved for fishing interests.
‖Partially investigated by British Columbia Water Rights Branch. See *Report for 1914*, p. H18.
[1]Nanaimo river, surveyed in 1914 from Cassidy cañon to lakes, and power possibilities investigated, by engineers of British Columbia Water Rights Branch.
[2]Includes area of Jump Creek watershed; Jump creek formerly called South fork.
[3]Above storage dam-site.
x Drainage area above mouth. y Drainage area above lake outlet.

VANCOUVER ISLAND—DISTRICT No. III—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Englishman river :	*	*	*	
391 Englishman falls (6m. above Parksville)	62	120	250	100 ft. fall in series of small falls and rapids; proposed dam 30 ft. No natural storage; stream flashy, with very low summer flow.
Little Qualicum river :				
392 Fall 3m. below Cameron lake	68y	100	....	Descends about 100 ft. in series of three falls in box rock cañon.
392 Lake to mouth	68y	400‡	3,500	612 ft. fall in 6½m. from Cameron lake to mouth. Storage by regulation of Cameron lake to high water mark, also in Labour Day lake. Head optional.
Qualicum river:				
393 Falls and rapids	44y	200‡	1,200	Falls reported, situation and height not determined. Horne lake, area about 4 sq. m., elevation 357 ft., 5½m. from mouth, might afford storage. Head optional.
Tsable river :				
394 Falls and rapids	30	....	....	Falls and rapids reported; no details available.
Puntledge or Comox river :				
395 Site No. 1 (Development, by Canadian Collieries, Ltd.)	250y	350	Ultimate 19,000§	350 ft. fall in 3½m. 2 units, each of 4,700 h.p., installed. Comox lake, area 9 sq. m., is 439 ft. above sea and 6m (direct) from Comox harbour. Concrete dam raises lake 23 ft. and provides useful storage of 132,000 ac.-ft. Estimated to maintain continuous flow of 800 sec.-ft.
395 Site No. 2 (Rapids below Site No. 1)	250y	58	4,000	58 ft. fall in rapids from power-house to tide-water; dam-site 2,000 ft. below present power-house.
Brown river : (trib. Puntledge river)				
396 Falls and rapids	8x	300	....	Direct fall of 8 ft.; 290 ft. fall in about 3m. rapids. No suitable storage sites; will probably be reserved for water supply purposes.
Cruikshank river (trib. Comox lake)	147x	....	....	No power possibilities in lower reaches; banks mostly low and flat. Said to fall 145 ft. in 7m. Small powers for local industries might be developed.
Trout lake and creek (trib. Comox lake)	12x	....	....	Creek has [illegible]; power possibilities small, if any. Might fur[illegible] power to local industries.
Tsolom river	150	....	....	No particulars re[illegible] and character of this stream. Wolf lake might [illegible] some storage.
Campbell river :				
397 Proposed development (by Campbell River Power Co.)	610	340	60,000[1]	Dam-site at outlet of Irene pool. Power-house at foot of cañon. Total head, with 25 ft. dam, 340 ft. Lesser head might be developed. Direct falls of 100, 20 and 30 ft. and steep rapids in rocky cañon. Excellent storage in Buttle, Upper Campbell and Lower Campbell lakes.
397 Thirty-foot fall	600	50	9,000[1]	30 ft. direct fall about 1½m. below Lower Campbell lake. Dam placed in cañon above might control Lower Campbell and McIvor lakes. Second fall and rapids are reported a short distance below. Further down, the river has low grade for some miles to Irene pool.
397 Maximum development	600y	450	100 000[2]	Total head between Lower Campbell lake and last cañon on river by diversion from east side of McIvor lake across big bend. (See page 172.)
397 Upper Campbell lake outlet	525y	....	....	Site for regulating dam. Fall between Upper and Lower Campbell lakes is about 100 ft. in 7m. No power sites reported.
397 Buttle lake outlet	325y	....	....	Site for storage dam. Fall between Buttle and Upper Campbell lakes is about 75 ft. in 14m. Said to be no power possibilities.
Elk river (trib. Upper Campbell river 4½m. below Buttle lake)	60	....	...	Falls 300 ft. only in 12m. above mouth. Said to have no power possibilities.
South fork, Elk river : (trib. Elk, 6m. above mouth)				
398 Rapids near mouth	25	175	600	175 ft. fall in 1,700 ft. rapids near mouth. South fork has total length of 13m. Several storage sites.

*See Description of Power Tables.

‡Assumed for purposes of estimate.

§Ultimate equipment—Flume line 3,400 ft. to forebay; 8-ft. wood-stave pipe 5,380 ft. long to Y; two 6-ft. wood stave pipes 4,500 ft. long to junction structure; four 50-in. wood-stave pipes 3,170 ft. long and four steel pipes 600 ft. long, to power house.

With regulated flow of about 800 sec.-ft.

[1]With regulated flow of about 2,000 sec.-ft.

[2]With regulated flow of about 2,500 sec.-ft.

x Drainage area above mouth. y Drainage area above lake outlet.

VANCOUVER ISLAND—DISTRICT No. III—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Wolfe creek (trib. Buttle lake) : 399 Fall 1m. from mouth........	50	70	500	Fall of 50 ft. at 1m. from mouth, above which grade averages 100 ft. per m. for 13m. Fairly regular discharge. Some storage obtainable in small lakes at headwaters of tributaries.
Marble creek (trib. Buttle lake) : 400 Rapids and falls............	Small	1,000‡	700	Small creek rising from 725 ft. at Buttle lake to 6,950 ft. within 3½ miles.
Philip creek.................... (trib. Buttle lake)	36	....	....	Steep creek, discharge very irregular ; owing to steepness of side hills and valley, no storage possible.
Myra creek (trib. Buttle lake) : 401 Rapids near mouth.........	35	300	900	300 ft. fall in ½m. rapids. Storage possibilities not known, probably small.
Price creek.................... (head of Buttle lake)	Small	....	....	About 9m. long, rises in glacier on divide between Buttle and Great Central lakes. Upper 6m. drains relatively small territory. No storage possibilities.
Thelwood creek : (trib. Price creek 3m. from mouth) 402 Rapids below lakes.........	25	1,200	4,000	1,200 ft. fall in 2m. rapids below lowest lake. Creek about 13m. long. Good storage might be obtained by small dams at outlets of four lakes at elevations of 2,150 to 3,280 ft.
Ralph river (trib. Buttle lake) : 403 Falls and rapids below lakes.	30x 15	300	600	Said that fall of 300 ft. could be utilized with run-off from 15 sq. m. Storage in three lakes at elevations of 3,230 to 4,116 ft.
Shepherd creek : (trib. to Ralph river) 404 Falls and rapids..............	25	250‡	500	Lower 4m. of creek have low grade and upper 4m. are very precipitous, rising to elevation of 6,000 ft.
Trout lake outlet : 405 Rapids.....................	Small	....	....	Said to have some small power possibilities.
Cranberry lake outlet : 406 Rapids.....................	26	....	....	Said to have some small power possibilities.
Salmon river : 407 Cañon 23m. from mouth....	550x 190	40	1,200	Dam-site in rocky cañon, walls 120 ft. high ; steep side hills above. If dam were more than 60 ft. high, would flood extensive valley ; grade low.
White river : (trib. Salmon river) 408 First cañon................ (2m. from mouth)	190	150§	5,000	Flows in deep rocky gorge. First cañon starts about 1½m. from mouth and continues for several miles. Numerous rapids in cañon, grade 20-30 ft. per m. Box rock cañon in places, several good dam-sites. Head optional.
408 Second cañon..............	....	....	....	Said to be more rapids in a second cañon several miles from mouth. No natural storage ; heavy freshets
Memekay river : (trib. Salmon river) 409 Cañon 2m. from mouth.....	60	120	1,300	Fall of 120 ft. in 2m. rapids. Dam-site at head in rocky cañon ; walls 120 ft. high.
409 Cañon 1m. above forks......	30	50	250	Rock-wall cañon. Good dam-site. If dam were over 80 ft. high, it would flood considerable area.
Adams river......................	....	....	....	Said to have no power possibilities on lower reaches of main stream.
410 East Fork cañon..	Not known	50	200	Rocky cañon at mouth of East fork and rapids above. 50 ft. dam said to be possible. Head optional. Low-water flow very small.
Tsi-itka (Robson) **river** : 411 Cañon 4m. from mouth.....	70	50	500	35 ft. head in falls and rapids in box rock cañon ; dam-site at head ; balance of head in rapids above. Storage small, if any.
Kokish river : 412 Cañon 3–6m. from mouth...	75‖y	500	10,000	500 ft. obtainable in about 2½m. rapids in rocky cañon. Several good dam-sites. Dam built at head of cañon on South fork might be made to control levels of Ida and Bonanza lakes, giving good storage. Head optional.

*See Description of Power Tables.
‡Assumed for purposes of estimate.
§Stated that over 150 ft. might be developed by succession of dams in cañon.
‖Above Ida Lake outlet.
x Drainage area above mouth. y Drainage area above lake outlet.

VANCOUVER ISLAND—DISTRICT No. III—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Nimpkish river:	*	*	*	
413 Dam-site 1½m. from mouth...	680	30	5,500	Dam-site at box cañon 1½m. from mouth. Dam 25-30 ft. high would back water up to level of lake Nimpkish, flooding some land between cañon and lake. Banks of lake are mostly steep and rocky, but, if lake were raised more than a few feet, would flood considerable land at head of lake.‡ High spring tides back water up to foot of rapids at dam-site.
414 Camosun cañon §.......... (5½m. above Nimpkish lake)‡	480	30-50	3,500	Dam-site at head of box rock cañon. Head of 30-50 ft. might be created. Still water in cañon, series of rapids above.
415 Big falls §.............. (2m. above Woss river)	330	40-50	3,000	Direct fall of 9 ft.; remainder of head in rapids above. Total head of 40-50 ft. possible by dam at falls. Steep side hills.
416 One-mile riffle§.............. (above Davie river)	185	50	1,500	35 ft. head in 1m. rapids. Dam of 12-15 ft. constructed at head of riffle in box rock cañon would back water up to head of little falls 2m. above. A higher dam might cause extensive flooding. Head of 50 ft. might be developed by 15 ft. dam and flume to near mouth of Davie river.
Quartz river:				
417 Rapids 1½m. below lake.....	Small, not defined	130	350	Quartz lake is said to be about 200 ft. above sea level. Stream for 1½m. below lake has low grade, then 40 ft. drop in ½m. and 90 ft. fall in 2m. below. Banks are about 20-30 ft. high. Quartz lake might be raised 10-15 ft. for storage.
Shushart river:				
418 Rapids in cañon............	30	150	1,200	Cañon starts 1½m. from mouth and continues for some 3m. Good dam-site in narrow box cañon ½m. from head; 150 ft. fall in 2m. below dam-site. Head optional. Total fall from head of cañon to sea level, about 230 ft. in 4m.
Ursie creek: (trib. Shushart river) Fall in S.W. quarter, sec 28..	....	20	....	Small creek with direct fall 17.5 ft.‖
Ice creek: (on Nigei island) Fall ½m. above mouth.......	....	....	....	Fall of 30 ft.; head of fall 110 ft. above sea. Small creek [1]

WEST COAST

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Sooke lake and river...........	112x 27y	....	....	Utilized for Victoria water supply. A power development of about 3,500 h.p. is possible, but the cost, it is stated, would be prohibitive.
Jordan river:				
419 B.C. Electric Ry. Co. development at mouth.....	53x	1,145	Present 25,000 Ultimate 38,000	Hollow reinforced Ambursen type concrete dam 890 ft. long, 126 ft. high. First two units 6,000 h.p. each. Pipe line 2,600 ft.; 50-inch diam. intake Y's to two 36-inch pipes reduced to 30-inch at power house. Third unit 13,000 h.p.; 54-inch pipe at intake reduced to 44-inch at power house. H.T. transmission 60,000 volts. Present development 25,000 h.p., ultimate development 38,000 h.p. Storage—Jordan River dam 612,000,000 cu. ft., Bear Creek dam 328,000,000 cu. ft.
Jacob creek: (Renfrew district) Fall in lot 745...............	Small	60	....	Small creek; direct fall 30 ft., remainder of head in rapids in lot 745.
Gordon river:				
420 Proposed diversion........... (1,000 ft. above Bugaboo creek)	86	155	2,500	Direct falls of 10·5 ft., 12 ft. and 13 ft., remainder of head in rapids. Development proposed by diversion dam, tunnel, conduit and steel penstock. Head optional. Four projects proposed with heads of 155 ft., 140 ft., 130 ft. and 115 ft. Initial dam proposed 20 ft., ultimately might be raised to 80 ft.

*See Description of Power Tables.
‡Portion of Nimpkish river above Nimpkish lake, is usually referred to locally as Klaanch river.
§*General Note*—The Nimpkish river falls nearly 600 ft. between Vernon and Nimpkish lakes. There are over 200 rapids in this distance of about 35 miles; all except four or five can be negotiated in a canoe. Probably only a small portion of this head could, economically, be made available for power. The three chief sites are indicated above, besides which there are one or two other points at which low heads of from 10-20 ft. might be developed. It would not be possible to create any effective storage in either Woss or Vernon lake, as the banks at the outlet are low. The grade of the river below each of the lakes is small and affords little, if any, power possibilities.
‖*Annual Report of Minister of Lands*, British Columbia, 1913, p. D375.
[1] *Annual Report of Minister of Lands*, British Columbia, 1913, p. D377.
x Drainage area above mouth. y Drainage area above lake outlet.

VANCOUVER ISLAND—DISTRICT No. III—Continued

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Walbran (Seven-mile) creek :				
421 Rapids	35	250	1,000	Stream descends about 250 ft. in 4m. rapids.
Carmanah river :				
422 Proposed diversion 3m. from mouth	25	....	....	Some small falls and rapids, height and other particulars not known. Power possibilities said to be small and difficult to develop.
Nitinat river :				
423 Cañon 1m. south of Vernon creek	75	60	800	60 ft. fall in 2,200 ft.
423 Fall at entrance Nitinat lake	180	....	....	Fall of 120 ft. reported.
McGoogin creek : (trib. of Nitinat river)				
McGoogin falls	Small	2,000	500–1,000	2,100 ft. head in less than 1m. Steep, rocky banks 15–20 ft. high, stream 15 ft. wide. Storage in McGoogin lake above falls, 1m. from Nitinat river.
Tsusiat river :				
424 Fall at mouth	9x	80	20	Practically no fall till near sea, then descends 80 ft. to sea level. Tsusiat lake, about 8m. long by 1m. at widest part, might afford storage.‡
Klanawaw river	73x	....	....	No reports.
Sarita river and lake :				
425 Rapids and falls below lake	58§	140	1,700	140 ft. head in ½m. falls and rapids below lake, rocky and precipitous banks 30–50 ft. high. Dam-site on rock ledge at outlet of lake ; power-house site at foot of lowest falls, below which river is navigable by lighters at high tide. Proposed to raise level of Sarita lake (area 335 acres) 20 ft. for storage. Proposed to divert West fork to lake.
Franklin river :				
426 Rapids and falls on South branch	S. Fork [illegible]	150	400	South fork descends 150 ft. in 2m.
Somass river :				
427 Somass falls, 2¾ m. from Alberni	475	10–12	1,300	Timber dam built 18 years ago for paper mill, now disused. Left bank high, right bank low. Storage on Sproat and Great Central lake systems.
Sproat river :				
428 Sproat falls (just below outlet of Sproat lake)	130y	60	3,000	44 ft. fall in series of cascades ; 15·5 ft. in 2,300 ft. rapids. Left bank sloping rock, right bank rougher. Limited storage in Sproat lake, elev. 70 ft., area 17 sq. m. Site at outlet for dam 40–50 ft. high.
Stamp river :				
429 Stamp falls (below mouth Ash river, 7m. northwest of Alberni)	315	110	12,000	40 ft. direct fall. Head obtained by 80 ft. dam. Limited storage in Great Central lake, elev. 260 ft. Drainage area mostly on high steep mountains with large glaciers and snowfields.
430 Upper Stamp falls (at outlet Great Central lake)	160y	30	2,000	Direct fall of 8·5 and 6 ft. ; 14 ft. fall in 4,400 ft. rapids. Limited storage in Great Central lake, area 20 sq. m. Good site at outlet for dam 25–30 ft. high.
Great Central lake :				
Suggested diversion to Sproat lake	160y	170	12,000‖	Great Central lake is 190 ft. higher than Sproat lake and is 2½m. distant ; the highest point of the divide is near Great Central lake and 54 ft. above it. The diverted water would increase flow over Sproat falls.
View lakes : (trib. Great Central lake)				
431 Suggested diversion to Great Central lake	3.75	746	750	View lake is about 746 ft. above Great Central lake and the divide is 26 ft. above East View lake. Dam might be built at outlet of View lake to give good storage. Good stand of timber on land that would be flooded.

*See Description of Power Tables.

‡For photograph of fall, see : "Southern Vancouver Island," by Charles H. Clapp, being *Memoir No. 13*, Geological Survey of Canada, Plate IV.

§Includes watershed of West branch.

‖The development of this site would modify discharge conditions and result in a redistribution of the power available at other points on the streams affected.

x Drainage area above mouth. y Drainage area above lake outlet.

Bute inlet. Mount Superb, elevation about 8,000 feet.

Gardner canal, showing stream of intermittent type descending from glacier above.

TYPICAL VIEWS OF THE COAST LINE BORDERING THE INLETS

VANCOUVER ISLAND—DISTRICT No. III—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Drinkwater creek : (trib. Great Central lake)				
Lower falls (2½m. from mouth)	20	150	[redacted]	90 ft. fall in 2,000 ft. ; series of falls in cañon, 100 ft. fall in 2½m. to mouth of stream, also rapids above. Head optional.
432 Upper Cañon rapids	Small	970	250	390 ft. in ½m. Lower cañon, 220 ft. in 1½m., 360 ft. in 1½m. Lower cañon to foot of Della falls. Total, 970 ft. in about 3m. Head optional.
Della falls	Small	1,580	[redacted]	1,580 ft. direct falls at outlet of Della lake, area 60 acres, a small glacier fed rock basin, elev. 3,700 ft. Good dam-site at outlet of lake. Some mine shafts might be affected.
McBride creek :				
433 North Fork rapids (below outlet McBride lake)	Small	100	250	100 ft. fall in 2m. rapids. Banks low, flat, wooded. Good dam-site at outlet of lake, 84 acres area.
Beaver creek :				
434 Cañon	Small	2,800	1,000	2,800 ft. fall in 1½m. Reported small lake at head ; not fully investigated.
Ash river :				
435 Dixon falls and rapids	132x	380 to 510	5,000	Direct falls of 67, 6 and 4 ft. ; 304 ft. fall in 3m. below big falls ; 130 ft. in 3½m. below small falls. Head optional. Banks easy slope, heavily timbered, but easy for construction of flumes and pipe line. Storage in Dixon lake and lakes above. Good dam-site at head of falls.
Canthook falls (about 4–5 m. above mouth)	132x	....	....	Reported falls.
Upper Ash river:				
Above outlet Elsie lake	77	....	....	No reports.
Nahmint river :				
Cañon 2m. from mouth	60	120a	2,000	88 ft. fall in 1,900 ft. in box cañon, 160 ft. fall in 4½m. rapids above, including 12 ft. drop near lake. Cañon, east walls 40–50 ft. high, west walls, higher: good dam-site at head. Narrow valley with strip of bottom land 400–600 ft. wooded side hills.
436 Falls ½m. below lake	50y	100b	1,500	Direct fall 12 ft. and rapids below (see particulars above). Good dam site at outlet of lake for high dam, exact head possible, not determined.
Total head in 5m.	50y	250	3,500	Possible head is over 250 ft. in 5m. ; includes a and b. Storage in Nahmint lake, area about 2 sq. m.
Effingham river	....	....	....	These rivers have not been investigated from a water-power standpoint. They are situated in a region of large annual precipitation, and many have steep grade. They would probably afford several power sites.
Bedwell (Bear) river	....	....	....	
Moyeha river	....	....	....	
Megin river and lake	..	....	....	
Burman river	....	....	...	
Gold river	....	....	.. .	Application has been made to develop about 4,000 h.p. on this stream.
Tahsis river :				
437 Falls and rapids (4m. from mouth)	....	....	....	Said to be small falls and rapids. Particulars unknown.
Mahatta river	....	....	....	These rivers have not been investigated, but are said to have some power possibilities.
Johnson river	....	....	....	
Ingersoll river	....	....	....	
Marble creek : ‡ (outlet Alice lake)				
Cabin falls (1m. from mouth)	....	65‡	3,500	Direct falls of 5 ft. and 15 ft. Box cañon 15 ft. high then sloping side hills. 50-ft. dam possible near falls
438 Cañon rapids 3½m. from mouth	....	100‡	5,500	44 ft. fall in 1,000 ft. rapids in cañon ; direct fall of 14 ft. about 450 ft. below cañon with low banks ; 50-ft. dam might be erected at head of cañon and total of over 100 ft. head developed.
Alice falls (4½m. from mouth)	195y	40‡	....	30 ft. fall in 200 ft. falls and rapids. Above falls, river has low grade to Alice lake. Good dam-site at head of falls, storage in Alice lake

*See Description of Power Tables.

‡*Note*—Alice lake is only about 150 ft. above sea level. The grade between the three power sites given is very low and obviously the total head that might be developed cannot much exceed 150 ft. plus any small amount that Alice lake is raised. Possibly a dam built at either the first or second power sites listed would drown out the falls above and control the level of Alice lake.

x Drainage area above mouth ; y Drainage area above lake outlet.

VANCOUVER ISLAND—DISTRICT No. III—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Amason creek :	*	*	*	
(outlet Victoria lake)				
439 Victoria falls...............	40	20s	....	Direct fall of 20 ft. at outlet of Victoria lake. Very low grade for 700 ft. below to Amason falls.
439 Amason falls and rapids below	40	100	1,100	55 ft. direct fall and 20 ft. in 300 ft. rapids below. Dam might be built to raise Victoria lake (elevation 275 ft.) possibly 30-50 ft. for storage. Below rapids river has lo[illegible] lice lake. This site includes a.
Benson river :				
(connects Kathleen and Alice lakes)				
440 Rapids below Kathleen lake..	90	40	1,000	[illegible] about 4,000 ft. Box cañon of soft limestone [illegible] might be built, but Kathleen lake [illegible] ft.) has second outlet to Alice lake, which [illegible] to be dammed if lake level were raised.
Elk river :	....	....	....	Fall of 15 [illegible] between Elk and Kathleen lakes. No [illegible]s. Above Elk lake river is very [illegible]
(connecting Elk and Kathleen lakes)				
Raging river :				
(trib. to Elk lake)				
441 Falls and rapids near mouth.	Not known	180	1,500	Direct fall of 110 [illegible] in 1,200 ft. rapids below; [illegible]. If dam were raised over [illegible] level of the 'Three lakes' [illegible] good storage. This constitutes a [illegible] developed [illegible] power.
San Josef river :				
442 Small tributary and lake....	....	....	....	Lake 2m. long by [illegible]m. wide; is 1m. north of San Josef river, and, it is said, would afford good small power at outlet.

*See Description of Power Tables.

CHAPTER XIII

Mainland Pacific Coast—Topography and Power Site Tables

THE Pacific coast of British Columbia is formed by the western slopes of the Coast mountains, and extends from the international boundary to Portland canal—a distance of over 500 miles.

In the valleys, and wherever there is sufficient soil on the mountain slopes, the coast is densely covered with heavy timber. Much of the area, however, lies above the timber line.

Water-power possibilities along the coast possess special advantages; the chief being that the whole region is one of very heavy precipitation. This varies from a little less than 40 inches annually along a narrow belt near Powell river—where the mountain ranges of Vancouver island exert their maximum influence in reducing precipitation on their eastern side—to about 200 inches near Princess Royal island. An average annual precipitation of 180 inches has been recorded at Swanson Bay on Graham reach. This heavy precipitation results in a high rate of runoff. For precipitation records, see Tables.

Other favourable features are that the harbours are accessible at all times of the year; plant operation troubles, due to ice conditions, seldom exist; and, further, all along the coast, and particularly nearer the heads of the various inlets, the mountains are covered with snowfields and glaciers, some of which are of vast size. Occasionally, these glaciers extend down into valleys lying but a few hundred feet above sea level. (See Plate 7.) The runoff from such snow and ice fields, especially in warm weather, materially augments the stream flow available for power development at times of deficient precipitation. The coast, with its numerous inlets or fiords, resembles that of Norway, which country has recently come into prominence as a field for large water-power developments in connection with electro-chemical industries. The fiords are bounded by steep mountain slopes and, in many places, precipitous walls rise sheer for hundreds of feet from the water's edge. The shorelines are marked by an absence of harbours and beaches. Near the heads of the inlets the mountains attain their greatest elevation and scenic grandeur. (See Plate 29, showing character of shores of inlets along coast.)

Most of the smaller rivers flowing into the various inlets rise in the Coast mountains. A number of the larger rivers, such as the Homathko, Klinaklini, Bellakula, Dean, Skeena and Nass, break through these ranges, although many of their tributaries and the larger portion of their watersheds, lie among the Coast mountains. In general the coast streams may be grouped under three main classes. In the first class may be placed those larger rivers flowing in longitudinal U-shaped valleys, which valleys may be considered as continuations or branches of the inlets, that have become filled with gravel or glacial silt.

Streams of the first class are characterized, at their mouths, by extensive tide-flats and sloughs strewn with logs, roots and other débris. The river usually reaches the inlet by several shallow channels, through gravel bars and glacial silt washed down from the mountains. Even with a small launch, great care has to be exercised in approaching these flats. In places, it is possible to anchor in six feet and have the stern of a launch overhang, say, fifty feet of water. In entering on the ebb tide it is easy to get aground and find the launch at low tide stranded on a flat with the nearest water a mile away. For typical views of heads of inlets with low land at mouth of larger rivers see Plate 30.

In their lower reaches, these rivers are usually swift-flowing streams obstructed by log jams and numerous 'snags' or 'dead heads.' They are often difficult to travel, and at high water a good deal of danger attaches both to the ascent and descent by canoe. The channel is often tortuous and changes from year to year. Examples of such rivers are the Toba, from its mouth to some miles above the forks ; the Homathko, to Waddington cañon ; the Klinaklini, as far as the Great glacier ; the Kitlope and several others. Rivers with the above mentioned characteristics, of course, offer little, if any, possibilities for power development.

In the second class may be grouped chiefly glacial, or snow-fed, streams flowing in narrow V-shaped valleys, often dropping several hundred feet in the last portion of their course, or plunging precipitously from great heights into the sea. It is upon streams of this class that the power possibilities of the Coast district are mostly found. The physical characteristics of these streams vary considerably. In many cases, the river flows in a deep cañon—frequently a box cañon ; in other places, rock slides occur. The river bottoms are usually strewn with boulders and contain frequent outcrops of bed rock. Often there are no conspicuous falls, although the river has numerous small pitches as it descends with a grade of 20 to 40 feet to the mile. In these cases the only practicable way of developing the latent power is to concentrate the head by dams in suitable locations. The amount of head obtainable is optional, and is generally limited only by constructional difficulties, or by the extent of possible flooding. A typical river of this class is the Klinaklini, in the Grand cañon above the Great glacier. (See Plate 31.) In some streams of this second class the grade is considerably steeper, perhaps 100 to 200 feet to the mile, but with no dam-sites at the lower ends. These may be developed by a low intake dam and fluming along a side hill to a convenient location for penstock and power house. This is the commonest type of coast river, and a good example is the Little Toba. Again, other streams of this class possess a series of water-falls, falling from an elevated or 'hanging' valley. The value of these, from a power standpoint, depends largely upon whether storage exists, or could be created. For views of typical streams of the class just described see Plates 31 and 32.

The information regarding the upper waters of many of the coastal rivers of British Columbia is comparatively meagre, but there is no doubt that many storage possibilities, as yet unknown, will be discovered in the future. Such

storage may be employed to impound the runoff from the glaciers and snowfields. (See Plate 32.) As precipitation on the coast takes place throughout the whole of the year, even comparatively small reservoirs, if at sufficient elevation and suitably located, may be of marked economic worth in connection with the development of powers. By way of illustration, attention may be drawn to Princess Royal island and adjacent coast, including Mussel inlet. In these localities there are streams issuing from lakes over natural rock dams, and falling one hundred to several hundred feet to salt water in a distance of from a few hundred yards to one or two miles. The development of the Powell river (see Plate 6) is an excellent example of what can be accomplished where larger lake storage is available.

The third class may be regarded as including streams of an intermittent character. These carry little water except on clear days when the sun is melting the glaciers or snowfields above or when rain is actually falling. They have no well defined valley, their courses being along joint planes or other accidental channels and, while often having very high heads, their flow is frequently too uncertain for practical power purposes. Where storage can be created, small powers may be available for at least several months of the year. On coast streams lowest water occurs generally about the end of January or during February, and many of the smaller glacial streams are then practically dry. For typical view of stream with intermittent flow see Plate 29.

The watershed areas have been determined from the latest maps, supplemented by information from other sources, but in several instances they are, of necessity, only indicative.

The following are brief notes of the more important inlets and streams :

Burrard Inlet The streams discharging into Burrard inlet belong to the coastal type and flow, for the most part, in V-shaped valleys with numerous falls and rapids. The Coquitlam-Buntzen plant of the British Columbia Electric Railway Co. on the North arm is the largest power development in the province. It diverts to Burrard inlet water which, normally, would flow to the Fraser river. Indian, or Mesliloet, river enters at the head of the inlet. An interesting proposal to utilize the waters of this stream and its tributaries is described on page 174.

Other tributaries, such as Capilano, Lynn and Seymour creeks, are chiefly of interest in connection with the water supply of Vancouver city and adjacent municipalities.

Capilano Creek is the present source of water supply for Vancouver. The watershed area is about 55 square miles, and, for the most part, heavily timbered. There is also a dense growth of underbrush on the lower slopes. The soil is gravel and sand with numerous boulders in the subsurface. In places where the forest covering has been removed the boulders are much in evidence. The runoff is rapid and, even under present conditions, the stream is subject to heavy freshets. If the existing forest cover were destroyed, the effect on the regimen of the stream would be serious. It is a matter of vital importance that the character of such watersheds with respect to forest cover be conserved. The grade of the stream averages 80 feet per mile. There are no reservoir

sites except near the headwaters, where the limited watershed would usually not yield sufficient runoff to warrant the construction of expensive dams.

Seymour Creek is the most important stream connected with the future water supply of Greater Vancouver. Unlike Capilano creek, it has storage possibilities which would be ample to ensure water supply over long periods of drought. The drainage area is about 76 square miles, consisting mostly of precipitous, wooded mountains, with peaks reaching an elevation of 6,000 feet. On the higher altitudes and in sheltered valleys at lower elevations snow usually remains all the year and, in hot weather, augments the flow.

Lynn Creek drains a watershed of about 17 square miles of high, steep, mountainous country lying between the watersheds of Capilano and Seymour creeks. In physical characteristics it is similar to the watershed of the latter.

Howe Sound

Howe sound is one of the better known inlets, because of its proximity to the more settled portions of the coast. The Squamish and Cheakamus rivers unite about eight miles from the sea and discharge into the head of the inlet. Other tributaries are short mountain streams with rapid descent.

Britannia Creek has been developed by the Britannia Creek Mining and Smelting Co. (See page 156.) At Porteau there is a small development for gravel screening, consisting of several Pelton wheels operating under a head of 300 feet. At Mill Bay the British Columbia Sulphite Fibre Co. has a development of over 1,000 horsepower.

Squamish River—The lower valley of the Squamish is flat, and, near tide-water, is open country. It has considerable areas of good land, although parts are subject to periodical overflow. The more serious flooding appears to be due to the breaking of log jams during freshets. At its mouth, the valley is about two miles wide ; 30 miles upstream it narrows, and the river passes through some cañons. There are several tributaries which, on entering the Squamish valley, have falls of varying height, but their power possibilities, however, appear to be small.

Cheakamus River valley, formerly one of the routes to the interior, has recently come into prominence, owing to the construction of the Pacific Great Eastern railway. The valley proper seldom exceeds one mile in width, and has very little agricultural land. The Cheakamus is a rapid, turbulent stream and, 10 miles above its confluence with the Squamish, it flows through a series of cañons. At other points the river bed widens out, and has numerous channels separated by gravel bars. The power possibilities of the cañons of the Cheakamus and some of the tributaries have not been fully determined, though some investigations have recently been made.*

Jervis Inlet

Jervis inlet is one of the larger coast inlets, but the drainage areas of its tributary streams are of minor extent, being, for the most part, but small mountain streams. Details respecting their power possibilities, if any, are not at present available.

* See *Annual Report of Minister of Lands*, British Columbia, 1912, pp. 269-272 ; also, *Altitudes in Canada*, 2nd ed., by James White, pp. 127 and 197.

Powell River drains Powell lake, the largest lake adjacent to salt water on the Pacific coast of British Columbia. It is a short stream and descends about 140 feet in one-half mile. This fall has been very advantageously developed by the Power River Company to supply power to its pulp and paper plant. (See page 165.) Powell lake is employed for storage.

Toba Inlet

Toba River, at the head of Toba inlet, drains an area estimated at 900 to 1,000 square miles. It follows a well defined channel between low banks with a fringe of cedar, spruce and cottonwood up to about four feet diameter. Behind this timber there is much swamp and alder bottom, with thick growth of underbrush. The country surrounding its headwaters is mountainous and little known. Its main valley is from one-half mile to four miles wide. There are no power sites on the main stream for the first 16 miles, to the forks, nor on the East fork—which is the larger branch—until the upper waters are reached. Here, the river rises rapidly but is small. The Toba heads in a glacier some 30 miles above the forks. Although there are no power sites on the lower reaches of the main stream, several fairly large tributaries have high heads. Cañon creek, a tributary of the East fork, 15 miles above the forks, is the best power site yet discovered in the Toba valley. (See Plate 32.)

Bute Inlet

The Southgate and Homathko rivers are the largest rivers flowing into Bute inlet.

Southgate River drains a watershed of about 475 square miles. It flows through a flattish valley, one to one and one-half miles wide, which has good soil and some valuable timber, mostly spruce and cedar. For 40 miles above its mouth there are no power sites and the banks of the main stream are low. Falls are found on the numerous glacial-fed tributaries, two of which, on the northwest side, are of fair size.

Homathko River, with a watershed of about 2,000 square miles, rises in the Central plateau near the Chilcoten country and flows through the Coast mountains. Its valley is important as one of the few feasible railway routes from the coast to the interior. Description of it may be found in the Canadian Pacific Railway survey reports.*

The Homathko valley may be considered in two portions; the upper, including the East and West branches, extends from their sources to Waddington cañon, eight miles below the 'forks'; the lower portion extends from Waddington cañon to the mouth.

The upper portion passes through the heart of the Coast mountains; the two streams are confined in narrow valleys with occasional deep ravines and rock cañons through which the waters dash impetuously. The East branch rises in lake Tatlayako, at an elevation of about 2,720 feet. In its passage through the Coast mountains it descends 375 feet in the first eight miles, and about 1,200 feet between the latter point and the 'forks'—a distance of 14 miles.

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* See *Report on Surveys and Preliminary Operations on the Canadian Pacific Railway*, by Sandford Fleming. For West Branch see *Report up to 1874*, pp. 18, 19, 109 and 152; also Plate 4. For East Branch see *Report up to 1877*, pp. 162-166, 169, 170 and 267-269; also, *Altitudes in Canada*, 2nd ed., by James White, pp. 125 and 129.

The West branch issues with low gradient from a chain of small lakes and, below Bluff lake, descends 575 feet in a distance of 34 miles. From this point, at elevation 2,285 feet, the grade steepens and the river falls about 1,150 feet to the 'forks,' a distance of about seven miles. Between the 'forks' and the foot of Waddington cañon—about eight miles—the river descends about 800 feet to an elevation of 355 feet. Waddington cañon is 3,600 feet long, and its granite walls rise several hundred feet. Immediately above the cañon the river widens. The portion of the river from Waddington cañon to the head of the steep section on both branches has been referred to as the Grand cañon. It should, if the demand arise, afford power by the construction of dams—probably high ones—at favourable sites. Recourse might first be had to some of the numerous high heads on the tributary glacial streams.

The lower portion of the valley, extending from Waddington cañon to the head of the inlet, presents the usual characteristics of the U-shaped valleys previously described. (See Plate 30.) It is from one to four miles wide; the bottom lands carry large Douglas fir and spruce and very large cedar, with cottonwood and alders on the low islands. The Homathko watershed contains many large glaciers. Ice river, for example, issues from a glacier only two miles from the main valley and only 300 to 400 feet above sea level. (See Plate 7.) In the summer months the Homathko is a turbid, rapid river, rising with the melting of the snow-fields and glaciers, and having, in addition, a distinct diurnal rise and fall due to the day and night temperature, respectively. After a few days of warm, bright weather the river carries a heavy flow. Its breadth at the foot of Waddington cañon is about 150 feet, but, below this point, in 30 miles, it frequently divides into two or more channels enclosing low islands of gravel and light soil. When the valley becomes opened up several streams might be developed for power.

Knight Inlet

Klinaklini River flows into the head of Knight inlet and drains an area of about 1,800 square miles. At its mouth there are extensive tidal flats and, for about 15 miles above, it flows in numerous channels over wide gravel bars, which, in places, stretch across the entire valley. On its floor, this valley has scarcely any large timber—a remarkable fact differentiating it from other valleys of the same general class. Except at extreme low water, the Klinaklini is exceptionally difficult and dangerous to ascend, but it is possible to canoe upstream to the 'forks,' a distance of about 15 miles. At the 'forks' the character of the stream changes ; one branch, the West fork, issues from a great glacier two miles from the 'forks,' and only 200 or 300 feet above sea level. This glacier extends across the bottom of an apparent continuation of the main valley and, on the sloping sides, large trees grow within a short distance of the ice ; on hot, clear days the volume of water from this source appears to exceed that in the Grand cañon. The East fork flows through the Grand cañon, which extends for upwards of 20 miles above the forks. The walls of this cañon rise in many places sheer for hundreds of feet above the water's edge (see Plate 31); at other places there are the usual steep slopes and rock slides. Below the 'forks,'

CHARACTERISTIC VIEW OF INLET ON COAST
East arm of Matheson channel.

TYPICAL DELTA LAND AT MOUTH OF LARGE U-SHAPED VALLEY
Kemano river, Gardner canal

TYPICAL VIEW SHOWING RIVER FLOWING IN U-SHAPED VALLEY
Channel divided by numerous islets. Homathko river, looking dowstream towards Bute inlet.

on the main stream, there are no power sites, and, although there are a few small glacial feeders with high heads, there are no tributaries of large size. Some small power possibilities exist on some of the glacial tributaries of the Grand cañon.

Knight Inlet to Burke Channel

Between Knight inlet and Bellakula are streams entering numerous smaller inlets. Details of the power sites on such are given in the tables.

Kingcome River rises about 40 miles from the mouth of Kingcome inlet and flows through a potentially agricultural valley about two miles wide. Fruit, hay and other produce are grown on two ranches near its mouth. The Powell River Co. has timber holdings in the valley and carries on extensive logging operations. Tide-water backs up about three miles. The main river has no power possibilities, but it has numerous swift glacial tributaries which would afford small powers.

Chuckwalla River empties into the northeast end of Kildala bay, Rivers inlet. It is navigable by canoe for 40 or more miles from its mouth. Tide backs up to one and one-half miles. The country is well covered with timber, mostly spruce in creek bottoms, and cedar and hemlock on the side hills.

Kildala River is some 50 miles in length and drains about 200 square miles. The tide backs up seven or eight miles. The valley is one and one-half to two miles wide and covered with fairly good timber. The Kildala cannery is situated near the river mouth. There appear to be no power sites on the main stream for the first 40 miles above its mouth.

Rivers Inlet

At the head of Rivers inlet, Owikano lake discharges through a short stretch of river four miles long. In this stretch there is a drop of 10 to 15 feet, but no power site. The lake is bounded by steep mountain slopes and bluffs and is subject to sudden squalls ; the rainfall is heavy. There is a Government fish hatchery on the lake. Numerous small powers exist on the tributary streams, the most easily developed being, perhaps, the Doos falls, on the Doos river.

Burke Channel

Bellakula River is one of the most important on the coast. There are over 500 settlers in the valley and a trail to the interior follows the river. The Bellakula rises in Charlotte lake, near the Chilcotin country, and flows 90 miles in a westerly direction to the North Bentinck arm, draining an area of about 2,200 square miles. Its valley is fertile and contains some good timber. The river is fed by a number of small creeks, which would yield power for a considerable portion of the year. Saw-mills already exist on two or three of these streams, but it is reported that the maximum power developed by the largest does not exceed 60 h.p. For 40 miles from its mouth, the Bellakula does not contain any suitable dam-sites, and it would be difficult to develop power, as the banks are low and the valley wide.

Dean River (sometimes called Salmon river) rises near the sources of the Chilcotin, and the upper part of its watershed drains a portion of the Interior plateau. Indeed, it may be said that the larger part of its watershed lies in the dry belt because, owing to the distance that Dean channel penetrates the

Coast mountains, the course of the river among the mountains is short, and lies along a narrow valley without the accession of large tributaries. Consequently, the watershed drained by this lower portion of the river is limited. The mean annual precipitation at Bellakula is only 40 inches, and it may reasonably be assumed that it does not much exceed this in the lower part of the Dean valley, though there is said to be a heavy winter snowfall. It is easy, therefore, to understand why the flow of the Dean river drops in summer to less than 1,500 second-feet. It is not improbable that it has a lower runoff per square mile than any other stream on the mainland coast of British Columbia. The Dean leaves the general level of the Interior plateau at a point six miles above the confluence with its chief tributary, the Iltasyouko. At this point it descends 80 feet in several pitches. From the foot of the fall, as far as the eye can see, the water continues through a cañon a foaming rapid. In the 50 miles to salt water, the river descends nearly 3,000 feet, or an average grade of about 60 feet to the mile. In its upper portion, however, the grade is much steeper and, even were there no suitable sites for high dams, it is a fair assumption that a considerable head could be developed by special means, such as tunnel, pipe-line or flume. Near its mouth the river flows through a small cañon where a low head could be secured.

Dean Channel to Gardner Canal

Dean channel to Gardner canal is a region of heavy precipitation, reaching, in places between Princess Royal island and the mainland, as high as 200 inches per year. Along this coast there are numerous water-powers, some of considerable size, and, generally, they are adjacent to salt water. The streams fall from one hundred to several hundred feet from a 'hanging' valley which often contains a lake. In many cases considerable power might be developed at low cost. Frequently, however, owing to the steepness of the shores, it would be difficult to secure sites for power houses without blasting such out of the rock. (See Plate 31.)

Gardner Canal

Gardner Canal has numerous tributaries, on most of which there are power possibilities. Triumph river, entering the head of Triumph bay, has two easily developed power sites with good storage. The Kitlope river has no power site below the lake, but numerous tributaries have possibilities of small developments. The main inlet sometimes freezes over from its head to below Kemano river, a distance of 25 miles.

Skeena River

In July, 1793, the estuary of the Skeena was explored by Mr. Whidbey, of Vancouver's staff. He appears, however, to have ascended no further than the mouth of the Ecstall river. Port Essington, the name originally applied by Vancouver to the whole of the estuary, is now applied to a settlement on the south shore.

In most inlets along the coast, deep water is found at the foot of the steep bordering shores. Above Port Essington, however, the bottom of the Skeena estuary has become filled with débris brought down by scour, so that deep water is not found where, from the character of the banks, it would be expected. Below Terrace, there is little agricultural land. Above Terrace, areas suitable for agriculture are found in the main valley and in the Kispiox, Lakelse and

Kitsumgallum valleys. About 20 miles below Hazelton, the higher terraces extend, in places, several miles back, with soil of fair quality. Considerable settlement is taking place in the Bulkley valley, along the line of the Grand Trunk Pacific railway. Near the headwaters, the watershed is rugged and mountainous—the ridges rising to 6,000 feet above sea level, with peaks of 7,000 to 8,000 feet. The main valley here is two or three miles wide, and has a fairly thick growth of small timber.

In its lower reaches, the Skeena valley is a region of marked humidity and heavy precipitation. At Hazelton, the climate resembles more nearly the conditions of the Northern interior.

The Skeena is tidal for a distance of 18 or 20 miles above Port Essington. Previous to the construction of the Grand Trunk Pacific railway, stern-wheelers ascended it to Hazelton, 180 miles from the mouth and 725 feet above sea level. Above Hazelton, however, all navigation is rendered impossible by a series of cañons and rapids extending over 100 miles. The Skeena usually opens at the end of April or early in May. Ice begins to run early in November, but, the current being very rapid, the river does not generally freeze over until the end of December.

Below Hazelton, the Grand Trunk Pacific railway debars power development on the main stream except under very special and expensive readjustment of existent conditions. Above Hazelton there are several cañons where power might, with difficulty, be produced. There are, however, a number of tributaries having rapids and falls lending themselves more easily to development.*

Kitsumgallum River enters the Skeena from the north about 90 miles above Prince Rupert. It is about 30 miles long and drains a well timbered valley containing, in its lower portion, some agricultural land. A cañon about six miles long commences about five miles from the mouth. Its average width is some 60 feet but, in places, narrows to 25 feet. The walls are of a hard greenish-gray rock, and rise almost perpendicularly to a height varying from 65 to 80 feet. There are no direct falls but numerous rapids occur over rock ridges. The current throughout is very swift. It is reported that this stream possesses some of the best and most easily developed sites in this portion of the Skeena watershed. On its upper portion there is a series of small lakes, the largest of which is Kitsumgallum lake.

Zymoetz (Copper) River flows through a deep but narrow valley with steep banks and joins the Skeena at Copper City, a settlement on the south side of the river about 98 miles inland. Its source is in a glacier-filled region among mountains over 6,000 feet high. The snow-line in August is at an elevation of 5,000 feet, and, during the summer, the river is thus fed from these snow-fields, as well as from the glaciers. The river forks about 26 miles from its mouth, the larger portion of its water coming from the North fork. The climate and vegetation of the valley belong to the coastal rather than to the interior types. On the lower slopes of the mountains there is a dense forest

* For a fuller description of the main valley of the Skeena, see *Geological Survey of Canada, Report of Progress*, 1879-80, pp. 9B *et seq*; also *Canadian Pacific Railway Reports*, 1878, Appendix C, p. 38.

of spruce, hemlock and cedar, interspersed with poplar and cottonwood, and the hillsides are carpeted with moss. Four miles from its mouth, it issues from a cañon two miles long, the walls of which are about 70 feet high. The head obtainable would be optional and dependent upon the height of dam. There are, no doubt, numerous minor powers on the smaller tributaries, which are mostly short, steep, mountain creeks. With the exception of one site on Granite creek these have not been investigated.

Bulkley River, entering at Hazelton, is one of the chief tributaries of the Skeena. It drains a watershed of about 4,500 square miles. Its chief tributaries are the Telkwa and Morice rivers, the latter being the extension of the main Bulkley.

The Bulkley valley is bounded on the west by the Bulkley and Coast mountains, and on the east by the Babine mountains. For the first twelve miles the valley is about four miles wide, and affords considerable areas of bench lands, which lie at an elevation of several hundred feet above the river. A large part of the former forest cover has been destroyed by fire and much of the timber now existing is small poplar, balsam, spruce and lodgepole pine. Above Bulkley cañon, the valley gradually opens out until, in the neighbourhood of Moricetown, 26 miles from the mouth, it attains a width of between eight and ten miles ; 30 miles farther up it widens to about 20 miles. Above Telkwa, the valley continues wide and rolling, is almost prairie-like in appearance, and is practically without timber. The Grand Trunk Pacific railway follows the valley and much of the land has been taken up for agriculture. The bordering mountain ranges contain agricultural valleys which are also largely occupied for farming and ranching.

The precipitation in the Bulkley valley is usually sufficient for agricultural purposes, although, in its upper portion, it approaches semi-arid conditions. The tributaries from the east have usually a smaller flow than those from the west, as the latter drain the eastern foothills of the Bulkley mountains.

For the greater part of its length, the Bulkley occupies a deeply eroded channel—practically a cañon—through which the waters rush with great force, forming numerous rapids where the channel narrows or rocky ledges are encountered. Near the mouth of the river the walls of the cañon are of precipitous rock, varying in height from 180 to 250 feet. (See Plate 33.) The main stream has several power sites (see Tables). The head obtainable in each case is to a certain extent optional and dependent upon the height of dam. At Moricetown there is a direct fall of about 13 feet.*

Telkwa River enters the Bulkley about 60 miles above its mouth and drains nearly 500 square miles. At its lower end, its valley is several miles wide, with extensive gravel flats, having a growth of small lodgepole pine and aspen. About eight miles upstream, the valley narrows in, and is enclosed by low rolling hills a few hundred feet high, while farther on, these hills merge into mountainous country. The upper waters of the Telkwa penetrate the eastern flanks of the Coast mountains, and receive the drainage from snow-fields and glaciers, which

* For illustration of Moricetown falls, Bulkley river, see *Fifth Annual Report, Commission of Conservation*, facing p. 104.

gives it, in a modified degree, the characteristics of a glacial stream. Much of the Telkwa watershed has been denuded of forest cover by fires. Between the 'forks' and its mouth, a distance of 15 miles, it falls 580 feet. The continuation of the main valley is comparatively wide and is drained by the North fork, which has a grade similar to that of the lower river. The South fork falls more rapidly, the grade, in places, exceeding 100 feet per mile. Howson creek, its largest tributary, falls into the South fork, nine miles from the 'forks.' Near the mouth of this creek there are two falls affording possibilities for small developments.*

Morice River is the main branch of the Bulkley and its watershed, of about 1,500 square miles, is largely unexplored. Much of the timber on the lower portion of the watershed has been damaged or destroyed by forest fires. The climate is essentially that of the northern interior, the precipitation probably increasing somewhat towards the headwaters. There are no falls or rapids in the first 14 miles, for which distance it has been navigated by a small steam launch. Above this, canoes have ascended the river to its source. It rises in several lakes lying in valleys which penetrate the eastern flanks of the Coast mountains. As these lakes are fed by glacial streams, the discharge of the river shows a perceptible increase during hot weather. If any appreciable control of the flow of the Bulkley can be obtained, it will be by regulating the outflow of the various lakes at the head of the Morice. The status of these lakes in relation to power sites on the Bulkley is, therefore, of prime importance and their outlets should be examined for possible dam-sites. The first power site on the Morice river is 21 miles upstream, at a rocky cañon about 600 feet long and 80 feet wide at its mouth. Other sites may exist further up.

Kispiox River joins the Skeena nine miles above Hazelton. The watershed lies on the easterly side of the Coast mountains, and a low range of hills separates its valley from that of the Skeena river. The watershed is thinly timbered with small poplar, birch, hemlock, spruce, balsam, alder and willow, and there is a light growth of hazel bushes along the stream banks. The northern banks of the lower valley are comparatively flat and bare, save for an abundant growth of wild grasses and weeds which afford desirable summer feed. Much of the land has been pre-empted for agriculture. The climate is that of the northern interior, with a moderate precipitation. The power possibilities of the Kispiox are small. Two dam-sites have been located on the main stream and some small powers on its tributaries. Particulars are given in the tables.

Babine River, as yet, has not been examined especially for power sites. Its general characteristics are, however, similar to those of the Skeena between Hazelton and the mouth of the Babine, which stretch of the Skeena is apparently not easily navigable even for canoes. This is indicated by the fact that the Indians and the Hudson's Bay Co., in transporting supplies from Hazelton, apparently find it safer and more economical to use a seventy-mile trail across country. The river rises in Babine lake at an elevation of about 2,220 feet.

* See 'The Bulkley Valley,' in *Summary Report of the Department of Mines, Geological Survey Branch*, 1907, pp. 19 *et seq.*

Babine lake, upon examination, might be found to afford storage, but its tributary watershed is relatively small. Babine river, from Babine lake to its junction with the Skeena, is some 50 miles long and descends in that distance about 1,475 feet by a succession of rapids without any distinct falls. The grade is, of course, not uniform, and there are probably many places where it considerably exceeds the average figure of 29 feet per mile. As the river flows in a cañon for a long distance there are no doubt several points where developments might be made by means of dams.

Nass River

Nass River is the most northerly of the Pacific Coast rivers which flow wholly through British Columbia. It heads in high mountains, but flows for the greater part of its length through a wide rolling plain traversed by slate ridges. The lower portion of the river, in crossing the Coast mountains, flows through a deep, narrow valley. The river is tidal for about 12 miles from its mouth and navigable by gasolene launch or stern-wheeler to the foot of the Pre-emption reserve, a strip of country 4 miles wide and 25 miles long, the lower extremity of which is about 30 miles from the mouth. The average open season for river transportation is from April 30 to November 1. During the winter months access can be had to the interior by somewhat hazardous transport over the ice, or by dog team *via* the Kitsumgallum trail from the main line of the Grand Trunk Pacific railway.

Below the Indian village of Guineha, about 20 miles from the mouth and 8 miles above the head of tide, the Nass flows between banks of mud or gravel 10 to 15 feet high and has a comparatively uniform current of about five miles per hour. The channel is 300 to 600 feet wide and 8 to 12 feet deep at low water. Near the mouth it winds from side to side of the valley, cutting many channels through the flat, clay bottom land. A small stern-wheeler can easily ascend this section of the river. Guineha is situated at the foot of the first cañon and from this point up, navigation is more difficult. The river is swifter and rock and gravel riffles numerous, but it is stated that navigation is possible by stern-wheelers up to the last good landing stage situated at the foot of the Pre-emption reserve. Except at very high or low stages, such boats might ascend a short distance further, but, above the foot of the reserve, the river courses through a slate cañon from 150 to 250 feet deep, and soon becomes unnavigable at all stages, even by canoes. Adjacent to the Pre-emption reserve the valley averages nine miles in width and is 200 to 500 feet above sea level. Enclosing the valley on the east is a very regular ridge of mountains 3,000 to 5,000 feet in height, broken only by the valley of the Cranberry, about a mile and one-half wide. On the west side, there is a similar ridge, but more broken.

The valley of the Nass is well timbered. There have been comparatively few fires in this region, and the burnt over areas are reforesting with spruce, cedar and hemlock. These trees characterize the Nass valley to a point 65 miles above the mouth of the river. North of Cranberry river cedar is absent, and above an elevation of 2,000 feet hemlock and balsam predominate, while lodgepole pine appears on the poorer and dryer soils.

The Nass in the cañon might be dammed for power purposes at several points. No damage would be caused by back flooding and the chief difficulties to overcome would be the great range between high and low stages of the river and, possibly, the finding of suitable sites for buildings. It has been suggested that, by means of a succession of dams, the total fall in the Nass river, between the upper end of the long cañon and the first cañon, might be utilized. The chief tributaries of the Nass are the Tseaxe, Kinskooch, Meziadin and Cranberry rivers and Brown Beaver creek, all of which have power possibilities.*

Stikine River

Stikine River.—In 1793, Vancouver entered the estuary of the Stikine river, the shoals of which are marked on his charts. Gold was discovered in 1861, and, in 1866 and 1867, explorations for the overland telegraph were extended to the Stikine country. In 1873, the placer mines of Cassiar were first developed, and, since that time, the Stikine has afforded an important means of communication from the coast to the interior.

The Stikine, like the Fraser, Skeena and Nass rivers, rises to the east of the Coast mountains, and cuts through them with nearly uniform gradient. In size and general character the Stikine resembles the Skeena. Navigation usually opens between April 20 and May 1 and closes before the end of November. It is navigable by stern-wheel steamers of light draught and power from its mouth to Glenora, 126 miles, and, under favourable circumstances, to Telegraph Creek village, 12 miles farther. The current of the navigable portion is swift, with an average current of, say, about five miles per hour. In many places between the 'big bend,' 23 miles from the mouth, and Telegraph Creek, it attains a rate of six to seven miles, the swifter water being chiefly met with above the Little cañon. There are no rapids, properly so-called, although the Little cañon (80 miles from the mouth) offers, at high stages, a serious impediment to navigation. The extensive flats at the mouth of the river render it necessary to enter at about high tide.

Between Telegraph Creek and the mouth it falls about 540 feet, giving an average descent of over four feet to the mile. The fall on the upper portion of this stretch considerably exceeds this figure. In ascending the river to Telegraph Creek it is often necessary to have a line from the shore for haulage. Above Telegraph Creek is the Great cañon, which extends for many miles and is quite impassable either by steamers or boats. Miners have travelled it in winter on the ice.

From Telegraph Creek a trail *via* the Stikine and Tanzilla leads to Dease lake, on the Liard waters. The headwaters of the Stikine lie for the most part in a mountainous district in approximate lat. 57° N., but are largely unexplored. Crossing the Alaska coast-strip, a distance of about 20 miles, the general trend of the valley is east and west. At the British Columbia boundary, it takes a north and south direction. From a point about 85 miles from

* See *Annual Report of Geological Survey of Canada*, Vol. VI, 1892-93, pp. 14 and 15 AA; also *Annual Report of Minister of Lands*, British Columbia, for 1913, pp. D79, D393, D397, and for 1914, pp. D182-D184.

the sea, it runs northeastward to the vicinity of Dease lake. The upper portion is occupied by the Tanzilla branch, the main river entering the valley from the southeast.

"The lower portion of this river-valley may, in fact, be regarded, like that of the corresponding part of the Skeena, as an inlet which has become filled with detritus in consequence of the great size and sediment-carrying capacity of the river. . . . The mountains immediately bordering the valley of the Stikine at its seaward entrance are from 2,000 to 3,000 feet in height, and rise abruptly from the wide alluvial flats, through which the river there winds. . . . The flats are generally covered with fine groves of cottonwood, mingled with spruce and other trees, and are often cut through by sloughs and channels. . . . The valley-bottom maintains an average width of from two to three miles as far up as the Little cañon, which place may be regarded as nearly marking the head of the old salt water inlet which has been silted up by the river."*

No general description of the Stikine would be complete without a reference to the glaciers which constitute one of the most remarkable features of the lower valley. While there are a number of these on both sides of the river, yet only four are of special importance. These four are situated on the west bank, three of them lying on the eastern slopes of the most massive central ranges of the mountainous region. For a description of these glaciers the reader is referred to the report of the Geological Survey.†

"The Little cañon is about three-fifths of a mile long, and, in places, not more than 150 feet wide. It is bordered by massive granite cliffs, 200 to 300 feet in height, above which, on the west side, rugged mountain slopes rise. On the east, are low rocky hills representing part of a former spur of the mountain, through which the cañon has been cut. A tract of low land separates these hills from the eastern side of the main valley, and it is difficult to explain under what circumstances the river has taken its present course.

"For some distance above the Little cañon the Stikine valley appears to cut very obliquely through a series of somewhat irregularly parallel ranges. Eight miles further up is the 'Kloochman cañon' . . . it is nearly 300 feet in width and offers no impediment to navigation. At four miles above the Kloochman cañon is the so-called Grand rapid, which, in consequence of recent changes in the river, is now by no means formidable, though the water is still particularly swift and the river wide and shallow. Here the valley begins very markedly to open out, the mountains retiring further from the river and decreasing in altitude, while irregular, basaltic hills, of no great height, appear between the river and the bases of the mountains."‡

The striking differences between the coast and inland climates have already been referred to and, as the more northern latitudes are approached, these contrasts are still fully evidenced. For example, while the annual precipitation at the mouth of the Stikine exceeds 60 inches, and in adjacent localities is over 100 inches, yet at Telegraph Creek, on the inland side of the moun-

*Geological Survey of Canada, Annual Report (New Series), Vol. III., 1887-88, Part B, p. 49.
† *Ibid.* pp. 51-53.
‡ *Ibid.* pp. 49-50.

KLINAKLINI RIVER, GRAND CAÑON

In traversing the Coast mountains, rivers often flow through great cañons.

STREAM ON PRINCESS ROYAL ISLAND

This stream is descending steeply from lake in hanging valley, as frequently found on coast.

RAPIDS ON THOMLINSON CREEK, TRIBUTARY OF TOBA RIVER

A typical coast stream, descending over 600 feet in four miles.

tains, it is so small that it is necessary to irrigate cultivated land. Again, near the coast there is the moisture which beclouds the sky, while on the other side of the mountains, no more than 80 miles away, clear, bright atmosphere prevails. In the vicinity of the Stikine the greatest precipitation probably occurs adjacent to the highest central ranges of the Coast mountains. The existence of important glaciers and the heavily snow-covered appearance of the mountains until late in summer bear testimony to a large snowfall. It has been stated that snow accumulates on the lower parts of the Stikine valley to a depth of eight or ten feet, while at Telegraph Creek, on the Tahltan river, the depth seldom exceeds eighteen inches. At the latter place horses have been wintered out.

On the eastern side of the Coast mountains, vegetation is much earlier than in the lower parts of the Stikine valley, where the larger quantities of snow retard the arrival of spring. About the middle of May, 1887, for example, the cottonwoods and other deciduous trees at the mouth of the Stikine and along its lower part showed merely a general faint greenish tint as the buds opened. At the same time, in the vicinity of Telegraph Creek the appearance was almost that of early summer. The character of the vegetation found in these different localities confirms the general testimony respecting the transition from the moisture of the coast to the dry climate of the interior. It is evident that the meteorological differences involved emphasize the necessity for individual study of watersheds over which runoff co-efficients doubtless vary within wide limits. As yet, opportunity has not been afforded for the examination of the numerous tributaries of the Stikine from the standpoint of their power possibilities. Such information as is available has been summarized in the tables.

Mainland Pacific Coast—District No. IV

	Name of Stream and Situation of Power Site	Area of watershed in square miles*	Selected head in feet*	Estimated horsepower*	Remarks
	BURRARD INLET				
	Coquitlam-Buntzen Development: British Columbia Electric Railway Co.				
443	Lake Buntzen	7	....	....	Lake Coquitlam diverted by high dam and tunnel 2½m. long to lake Buntzen, 400 ft. above the two power houses on Burrard inlet. Area lake Buntzen about 500 acres; original area lake Coquitlam about 2,190 acres. See page 151.
443	Lake Coquitlam	105	....	....	
443	Power House No. 1	....	400	43,500‡	
443	Power House No. 2	....	400	40,500‡	
	Indian (Mesliloet) **river**:§				
444	Power site at mouth Hixon creek; intake 2½m. above	65	350	3,000	350 ft. fall in about 2½m. rapids.
444	**Hixon creek**	Small	1,960	10,000	1,960 ft. fall in about 2½m. Storage by proposed 40 ft. dam at outlet of Belknap lake.
444	**Brandt creek**	Small	1,960		1,960 ft. fall in about 4m. Intake at elevation 1,966 ft. above power house.
444	**Norton creek** (trib. Brandt)	Small	1,960		Storage in Norton lake, elevation 2,216 ft. above power house. 40 ft. dam proposed at outlet lake, and intake at elevation 1,966 ft.
444	**Young creek** (trib. Brandt)	Small	1,960		Storage in Young lake, elev. 2,214 ft. above power house, and in Don lake; proposed 50 ft. dam. Intake, elev. 1,966 ft. above power house.
	Granite Falls creek: (trib. Burrard inlet) Coast Quarries development	Small	300	200	300 ft. developed; proposed to increase to 500 ft.; 1,000 to 1,500 ft. can be obtained. Quarry plant requires 250-400 h.p. to operate fully, but in dry season only half this is available; record for 2,000 miner's inches.
	Sellust creek: Suggested development	....	....	....	Stated that over 1,000 h.p. is available on this creek at certain seasons
	Scott-Goldie (Crocker) **creek**: Development by Scott-Goldie Quarry Co.	....	....	1,500	Partially developed.
	HOWE SOUND				
444a	**Deeks creek**: **Kallahne creek**: Development by Deeks Gravel and Rock Co. at Porteau	4	300	300	Quarry and gravel screening plant. Storage of about 1,700 acre ft. in Deeks lake, elev. 3,200 ft. Timber crib dam 20 ft. high. Flume at elevation of 1,000 ft. diverts water from Deeks creek to Kallahne creek, power house near sea level, intake 2m. from mouth. Four Pelton wheels driving crushers and screens
445	**Furry creek**: Development by Howe Sound Copper Co.	....	....	....	Water is diverted from Furry creek by means of flumes, tunnels and pipes to power house at Britannia Beach.
	Britannia Creek:				
446	Development by Britannia Mining and Smelting Co.				
446	Tunnel power house (at elevation 2,084 ft.)	....	1,464	1,950	Extensive and interesting development for mining purposes. Power is developed at five points under seven heads. Some storage has been obtained by high dams. Steel and wood-stave pipes are used. Prime movers are Peltons. Beach and Tunnel power houses are electrically connected and run in parallel. Total h.p. of water wheel units about 12,650. Steam auxiliary; one 500 k.w. and one 2,000 k.w. unit. See page 156.
446	do.	....	838	785	
446	Beach power house (at elevation 165 ft.)	5.46	1,790	8,490	
446	do.	....	625	220	
446	Old Concentrating mill (at elevation 50 ft.)	....	695	300	
446	New Concentrating mill (at elevation 50 ft.)	....	665	500	
446	Beach Compressor house (at elevation 5 ft.)	....	1,945	400	

* See Description of Power Tables.

‡These figures show h.p. of plant installed; the continuous h.p. available is a total of about 37,000 for the two power houses.

§Proposed to build common power house near junction of Hixon creek and Indian river, and bring water from Indian river and tributaries at various heads.

MAINLAND PACIFIC COAST—DISTRICT No. IV—Continued

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Shannon creek:				
447 Rapids	Small	....	....	A small development was suggested for this stream; no details available.
Mamquam river:				
448 Falls below Goat creek	....	....	....	Proposed development by Manquam Falls Power Co.
Cheakamus river:				
449 Bear Mount cañon	200	385	40,000	560 ft. fall in 3m. rapids. Proposed development by B.C. Power and Electric Co.; probably head optional. Storage in Garibaldi lake, area 3,380 acres, and Cheakamus lake, area about 2,400 acres.
449 Power site, 5m. below Stoney creek	....	....	....	No details available, head probably optional, depending on height of dam.
449 Site, 2m. south of junction of North fork	....	....	....	No details.
449 Site, 1m. south of junction of North fork	....	..	....	No details.
Rubble (Stony) creek: (trib. Cheakamus)				
450 Rapids with power site at mouth	....	400	1,000	400-500 ft. head might be developed. Storage in lake.
Brandywine creek: (trib. Cheakamus)				
451 Rapids	....	....	....	Fall of about 200 ft. reported; half-mile from mouth.
Squamish river:				
452 Cañons 30m. from mouth	240	....	....	Said to have power possibilities—also small powers on tributaries.
Ashlu creek (trib. Squamish):				
453 Falls about 1½m from mouth	....	....	....	Reported falls, height not ascertained. Glacial fed stream. Said that 2,000 h.p. is available.
Monmouth creek: (trib. Squamish)				
Suggested development	....	....	....	900 h.p. is said to be available at certain seasons.
Second waterfall: (trib. Squamish 22m. from mouth)				
454 Falls ½m. above mouth	Unknown	250	....	Largest of three similar streams, but flow is small. Estimated direct fall 80 ft., total 250 ft. in short distance.
Mill creek:				
455 Development by British Columbia Sulphite Fibre Co.	....	600	1,000	Two Peltons developing 1,500 h.p.; 100 h.p. electrical; balance direct connected to grinders and other machinery.
	....	325	500	
Cedar creek:				
455 Suggested development	....	....	....	Proposed development by the British Columbia Sulphite Fibre Co.: 2,000 h.p. said to be available.
STRAIT OF GEORGIA				
Chapman (Mission) **creek**	....	....	....	Stated 800 h.p. is available on this creek.
SALMON ARM				
Clowhom river (at head):				
456 Rapids and fall near mouth	140	130	6,600	Direct fall over 60 ft. Storage in Clowhom lakes.
JERVIS INLET‡: JERVIS INLET TO MALASPINA INLET				
Powell river:				
457 Development by Powell River Co.	600	147	24,000 developed	Falls of 140 ft. in short distance near salt water. Excellent storage in Powell lake, original area about 65 sq. m. Lake level has been raised about 25 ft., proposed to raise it additional 25 ft. Present development 24,000 h.p. installed. Ultimate development with additional head about 32,000-35,000 h.p.

*See Description of Power Tables.

‡Jervis inlet is one of the larger fiords of the Pacific coast. It has, however, no large rivers flowing into it. The tributary waters are mostly mountain streams with relatively small watersheds. Probably many of these would afford facilities for power development for local requirements, but no details are [illegible].

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
MALASPINA INLET				
	*	*	*	
Theodosia creek :				
458 First falls on main stream... (500 yards above forks)	40	30	150	25 ft. direct fall, 6 ft. in 300 ft. rapids below. Dam-site (10 ft. or more) just above falls. Banks solid rock. Stream forks 2½m. above mouth.
Second falls .... (¾m. above first falls)	40	20	100	8 ft. direct fall, 8 ft. fall in 300 ft. rapid above. Banks 15 ft. high, rocky ledges ; stream 50 ft. wide at fall.
East Branch falls........... (200 yards above forks)	12	30	50	13 ft. direct fall, 16 ft. in 600 ft. rapid above. Dam-site about 50 ft. above falls: rock banks and bottom.
HOMFRAY CHANNEL				
Lloyd creek :				
459 Suggested development......	....	....	....	Stated that 2,000 h.p. might be developed at certain seasons.
Forbes river :				
460 Cascades 1m. from mouth...	25	25[illegible]	1,000	50 ft. in 1m. rapid, 110 ft. cascades in 800 ft., over 80 ft in three falls in 1,000 ft. Total in distance of 1½m., 250 ft. Dam could be built above east falls. Easily developed.
TOBA INLET				
Chewson creek :				
461 Cascades near mouth	40	800	5,000	500 ft. cascades in 2,400 ft., 17 ft. in 300 ft., and 250 ft. in 2,700 ft. Rock dam-site above upper cascades Creek forks about 1m. above 2nd cascades. Tota. head, dam-site to beach, about 800 ft.
Toba river....................	900x	....	....	No power sites on main stream below forks 16m. from mouth. Banks low. Valley ½ to 4m. wide.
Hazel creek (8m. up Toba) :				
462 Mackenzie falls.............	Un-known	800-1,000	3,500	Series of high falls at edge of Toba valley. 800 ft. head visible from valley, probably more head above.
Little Toba river (trib. Toba) :				
463 Rapids below Big creek ..... (4m. from mouth)	....	....	....	90 ft fall in 1½m.
Rapids above Big creek	....	....	....	100 ft. fall in 1m., 50 ft fall in next ¾m.
Total in 3½m..............	36	250	1,600	Swift river, no direct fall for 6m Rapids start about 2m. from mouth and river rises about 250 ft in next 3½m. Head optional, more rapids above, but river rapidly diminishes in size towards head.
North fork Toba river..........	....	....	....	Swift-flowing river, no fall or power sites for 15 to 20 m., rapids at head but river then small.
Falls creek (trib. North fork Toba, 10m. from forks) :				
464 Falls in rock cañon near mouth	Un-known	500-1,000	5,000	Series of falls in rock cañon. Head optional, probably over 1,000 ft. might be obtained in short distance.
Owens creek (trib. North fork Toba, 14 m. from forks) :				
465 Rapids and fall near mouth..	Un-known	over 300	2,000	Series of falls and rapids. Head optional, 500 ft. or over might be obtained in short distance. Flow small in winter.
Thomlinson creek (trib. South fork 11m. from forks) :				
466 Rapids and falls about ½m above mouth............	Un-known	over 620	5,500	50 ft. fall in ½m. rapids ; 90 ft. in ½m. ; 270 ft. in 1m. ; 210 ft. in about 2m. Rapid mountain stream, 620 ft. head in about 4m. Head optional. More head higher up stream in rocky valley, box cañon in places.
Cañon creek (trib. South fork Toba 15m. above forks) :				
467 Cañon and falls near mouth.	Un-known	over 1,000	17,000	Series of falls for first few miles. 375 ft. in ½m., 150 ft. in next ½m. and further falls and rapids for 6m. up stream ; head available within 3m., over 1,000 ft.
East fork Toba river : ‡				
468 Snow-slide rapids........... (29m above forks)	Un-known	70	400§	70 ft. in ½m., banks mostly rock slide.
First falls. .... (31m above forks)	Un-known	360	2,000§	360 ft. in 1½m. rapids in box cañon, walls 150-250 ft. high ; direct fall at head of cañon. The above might be combined to give 430 ft. head in 2m
Second falls............... (32m. above forks)	Un-known	530	2,300§	530 ft. fall in series of falls and rapids, for 1½m, box cañon. Glacier fed.

*See Description of Power Tables.
‡Also called South fork.
§Winter conditions unknown, flow probably unreliable

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Summit creek (trib. South fork Toba, 29m. above forks) :	*	*	*	
469 Rapids near mouth	Un-known	1,000	1,000‡	Small creek ; flows down rock slide in steep rapids.
Goat creek (trib. South fork Toba, 31m. above forks) :				
470 Falls	Un-known	550	500‡	550 ft. fall in ½m. Creek falls directly over precipice ; steep rapids from foot of fall to mouth.
Elite river : (enters Toba 2m. above mouth)				
471 Rapids	75x	....	....	No power sites on lower reaches of river. Low gravel banks. Rapids and power possibilities above.
Tahumming (Graveyard) **creek**:				
472 Falls and rapids near mouth	30	200	1,000	40 ft. direct fall : 17 ft. in 1,200 ft. rapids : 25 ft. fall in 20 ft. ; rock banks ; 31 ft. direct fall, box cañon, walls 70 ft. high ; 82 ft. in 1,800 ft. falls and rapids. Stream runs in rocky cañon and a total head of 200 ft. might be obtained
Brem river : (north side of Toba inlet)				
473 Rapids and falls near mouth	90x	250 to 300	4,000	35 ft. in 1m. rapids below fall ; 40 ft. f[illegible]n short distance in cañon; 60 ft. in ½m. above fall. 95 ft. in 1½m rapids ; 65 ft. in 1m. rapids ; 50 ft. in 1m. rapids Total head in 3½m about 250-300 ft . in 5m. about 345 ft. Rapid boulder stream in narrow valley. Head from below falls to a mile or two above easily developed. Two tributaries on east bank have small power possibilities with high heads. More rapids above.
BUTE INLET				
Salmon river (Orford bay) :				
474 Falls and rapids in box cañon 4½m. from mouth	200	130	4,500	20 ft. direct fall at head of cañon ; balance of head in series of smaller falls and rapids in ½m. cañon below. Dam-site at head of cañon where grade flattens out ; more rapids above. Easily developed power site.
Southgate river	350	....	....	Said to be no power sites on main river for over 40m. from mouth. Has small glacial tributaries with high falls.
Twenty-two-mile creek (north-west bank of Southgate river) :				
475 Falls near mouth	Un-known	600	3,000	500-600 ft. fall in ½m. of rapids and falls, including one fall of 125 ft. and one of 85 ft. Head optional.
Elliott creek (trib. Southgate)	Un-known	....	....	Said to be no power sites on this creek for 5m. or more.
Midway creek (between Southgate and Homathko rivers) :				
476	60	....	....	Said to be no power possibilities on this creek for 5 to 6m. up. Fed by numerous small waterfalls on each bank coming from glaciers above.
Homathko river : §	1,950x			
477 Waddington cañon (8m. below forks)	1,400	50'	6,000¹	Cañon 3,600 ft long, granite walls rising several hundred feet. River widens above cañon. Between 'forks' and foot of cañon it falls about 800 ft.
478 East Fork cañon	700x	100'	6,000¹	Rises in lake Tatlayoko, descends about 375 ft. in first 8m., and 1,200 ft. in 14m. of rapids in deep, narrow valley with many cañons.
479 West Fork cañon	680x	100'	6,000¹	Rises in several small lakes ; descends about 1,150 ft. in 7m. above 'forks.'
Ice river (trib. Homathko, about 11m. from mouth) :				
480 Rapids and two cañons	Un-known	200	2,500²	Fall in 5m. from foot of glacier to Homathko valley about 300 ft., of which about 200 ft. might be developed. Dam site at head of box cañon. Flow very irregular. Small snow-fed tributary near glacier has high head and might be easily developed.
Eckheimick river (trib Homathko, about 12m. from mouth) :				
481 Rapids near mouth	Un-known	200	4,000²	Fall from edge of Homathko valley to 4m. above, about 270 ft., of which about 200 ft. might be developed. More fall and rapids above. Head optional. Glacier fed

*See Description of Power Tables.

†Winter conditions unknown, flow probably unreliable

§See *Report on Surveys and Preliminary Operations on the Canadian Pacific Railway* by Sandford Fleming. For West branch, see *Report up to 1874*, pp. 18, 19, 109 and 152, also plate 4. For East branch, see *Report up to 1877*, pp. 162-166, 169, 170 and 267-269.

Assumed for purposes of estimate.

¹Rough estimates.

²Very large glacial flow in summer ; winter conditions unknown, flow probably fluctuates between exceptionally wide limits.

x Drainage area above mouth.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Bedell creek (trib. Homathko about 15m. from mouth) :	*	*	*	
482	Cascades 1m. from mouth...	....	375a	....	375 ft. fall in 1,500 ft. cascades in box cañon, banks 20-40 ft. high.
	Rapids above...	....	285b	....	285 ft. in 2,000 ft. rapids, bed strewn with large boulders.
	Total in ½m...	....	660	3,000	Total 660 ft., including (a) and (b), in about ½m. cascades and rapids.
	Second west tributary : (to Homathko)				
483	1st rapids, ½m. from mouth...	....	150a	....	150 ft. in 1,300 ft. rapids ; banks 15-20 ft. high ; bed gravel and boulders.
	Falls...	....	250b	....	250 ft. in 1,800 ft. falls and rapids in cañon ; walls 70-300 ft. high.
	2nd rapids...	....	240c	....	240 ft. in 1m. rapids ; boulder-strewn bed.
	Total in 2m...	Un-known	650	3,000	Total of 650 ft. in about 2m. : includes (a), (b), (c). Good dam-site above rapids; glacial fed.
	Third west tributary : (to Homathko)				
484	Falls 800 ft. from mouth...	Un-known	300	1,500	Descends 300 ft. in 1,000 ft. rapids in cañon ; banks 70-200 ft. high, bed rock in places in stream. More falls and rapids above; glacial fed.

PHILLIPS ARM

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Phillips river :				
485	...	150x	....	....	Has no power sites for 15m., above which stream is small.

LOUGHBOROUGH INLET

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Apple river...	30	....	....	Said to be no good power sites on this river.
	Mink creek (trib. Apple)				
486	Rapids ½m. from mouth...	12	200	400	210 ft. in ½m rapids, dam-site ½m. up. Glacial-fed stream.
	Stafford river : (trib. Loughborough inlet)				
487	1st rapids... (800 ft. from mouth)	....	40a	....	40 ft. in 2,600 ft. rapid ; low banks.
	2nd rapids...	....	115b	....	115 ft. fall in 1,000 ft. series of falls in cañon, walls 30-70 ft. high.
	3rd rapids...	....	50c	....	50 ft. fall in 2,000 ft. rapid ; boulder-strewn bed.
	4th rapids...	....	15d	....	15 ft. fall in 50 ft. cascade.
	Total in about 1½m...	70	210	4,000	Total head in about 1½m. 210 ft. : includes (a), (b), (c), (d). Storage in small lake, 1½m. long by ½m. wide Dam-site above 4th rapids.

KNIGHT INLET

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Wawkash creek :				
488	1st rapids near mouth...	....	130a	....	130 ft. fall in about ½m rapids ; dam might be built above rapids.
	2nd rapids near mouth...	....	230b	....	230 ft. fall in about 3m. ; several possible dam-sites.
	Total in about 3½m...	95	360	6 000	360 ft. fall in 3½m. : includes (a) and (b), dam-site above 2nd rapids, bed rock in stream.
	Awashmaaki river :				
489	...	145x	....	....	Partially examined in lower reaches. Power possibilities said to be small.
	Klinaklini river :				
490	Rapids in Grand cañon, (15-25m. from mouth)...	1,100	100–150	15,000	Box rock cañon with rock slides in places, steep side hills. Numerous places where dams might be constructed to back water up cañon, head obtainable being only limited by height of possible dam. No particular rapids or falls at any one spot, but grade increases as river is ascended. Cañon examined for 15m. and said to extend to summit country in Chilcotin district Little if any storage possible. Cañon walls 150-600 ft. high, sheer in places. River bed 50-300 ft. wide.
	Mussel creek (trib. to Klinaklini, 5m. from mouth on east bank) :				
491	Rapids below lake...	Small	300	300	250-350 ft. fall in 3m. Storage in three small lakes at head.
	Slide creek (trib to Klinaklini on east side 25m. from mouth) :				
492	Rapids in cañon near mouth	Un-known	360	3,000	360 ft. head in 2,000 ft. in cañon. Dam-site at head.
	Sim creek (to Knight inlet on west side 5m from head) :				
493	Rapids 2m from mouth...	180	280	6,500	280 ft. fall in 1½m. rapids. Small storage at head of rapids by possible dam, 4m. from mouth, rock banks

*See Description of Power Tables.
x Drainage area above mouth.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
KINGCOME INLET				
Kingcome river:	*	*	*	
494	450	....	....	Said to be no power sites in lower reaches; low sandy banks. Numerous glacial tributaries
Wakeman river:				
495	225	....	....	Said to be no power sites below forks about 14m. up; low gravel banks. Fed by glacial streams.
DRURY INLET				
Huaskin lake:				
496 Possible diversion..........	Un-known	130	600	Possible head obtainable by cutting through 600 ft. of bank at southeast corner of lake and discharging into Turnbull cove. Storage dam might be built at present outlet
SEYMOUR INLET				
Warner Inlet lake:				
497 Fall below lake............	10	70	200	Direct fall 66 ft. at salt water. Storage in small lake, 95 ft. above sea, area about 150 acres; dam-site 200 ft. below lake, rocky banks. Good sitef or small development.
Seymour river:				
498 Falls 2½m. from mouth......	110	165	4,000	165 ft. fall in 1,500 ft., series of falls in box rock cañon 30 ft. wide, 75 ft. high. Greater head possible further up stream.
RIVERS INLET				
Sandle Creek:				
Sandle Lake outlet.........	....	65*a*	....	65 ft. in ½m. rapids. Natural dam at outlet of lake, might be raised 15 ft. to give head of 80-85 ft.; rocky banks 15-25 ft. high. Partially developed by Good Hope cannery.
499 Rapids between lakes.......	....	250*b*	....	About 250 ft. in 3m. rapids between small lake and Sandle lake; rocky cañon; storage in Sandle lake, level might be raised 20-40 ft.
Total in 4m................	25	300	3,000	Total in about 4m., Sandle lake to salt water, including (*a*) and (*b*), about 300 ft.
Whonnock river:				
Outlet Owekano lake........	....	....	....	Owekano lake is only 10-15 ft. above high tide and Whonnock river has no power sites.
TRIBUTARIES TO OWEKANO LAKE				
Hatchery (Nutarvis) **creek:**				
500 Falls and rapids near mouth.	20	350	1,000	Rapid mountain stream in narrow valley, with steep, rocky side hills; 40 ft. fall in rapids below 1st fall to lake; 210 ft. in series of falls and rapids in ½m.; 150 ft. in ¾m. continuous rapids. Head optional. Intake for hatchery purposes at foot of 1st falls about 200 yds. from lake.
Dallick river:				
Rapids near mouth.........	40	30-35	300	30-35 ft. in ½m. Possible dam-site near lower end of rapids. Above rapids, smooth water for 3m
501 Falls and rapids about 4m. up	30	60	400	15 ft. fall in 600 ft. rapids below falls, 45 ft. fall in 600 ft. Falls and rapids formed by huge rock slide. More rapids above for short distance and then river flattens out into lake which would probably afford small storage.
Doos river:				
Doos falls.................	....	120*a*	....	120 ft. head in series of falls near mouth; above falls river flattens out, rising 15 ft. around U-bend. Easily developed power.
502 Rapids in cañon............	....	160*b*	....	160 ft. head in series of rapids and falls in places in narrow, box cañon. Head optional, more rapids and falls above.
Total (*a*) and (*b*)...........	100	280	6,000	Doos falls and rapids above might be combined to give upwards of 280 ft. head.
Neechantz river:				
503 Dam site 3m. from mouth...	240	20	1,000	20 ft. head in 1,000 ft. rapids. Side hills steep. River at dam-site about 60 ft. wide, widens out above. There are other dam-sites above, but said to be no marked falls.
Macmell river.................	....	....	....	Said to have no power possibilities in lower reaches. Largely of glacial origin.

*See Description of Power Tables.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
		*	*	*	
	Genesee creek :				
504	Falls and rapids ½m. from mouth	Small	800	2,000	120 ft. direct fall, 700 ft. in 1½m. cascades. Storage in Genesee lake, area about 280 acres. Dam-site 200 ft. below lake in narrow gully.
	Shimahents river :				
505	1st rapids, 13m. from mouth	240	50	2,500	50 ft. fall in about ½m. Dam-site where river narrows to 70 ft.
	2nd rapids, 14m. from mouth	....	40	2,000	40 ft. head in ½m. Above this river is said to flatten out.
	Tsao river :				
506	1st rapids, 1m. from mouth	20	60	300	60 ft. fall in rapids in small box cañon ½m. long.
	2nd rapids, 3m. from mouth	....	20	100	Rapids in ½m. box cañon. Good dam-site at foot.
	Indian river :				
507	Falls in box cañon ½m. from mouth	30	200	1,400	200 ft. fall in 1,000 ft. rapids in box cañon. Good dam-site at upper end of falls, but no storage possibilities.

RIVERS INLET—EAST ARM

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Chuckwalla river	115x	....	....	Said to be no power sites; navigable by canoe for 40m.
	Kildala river	200x	....	....	Said to be no falls for 40m.

RIVERS INLET—NORTH ARM

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Moses creek :				
508	Cañon falls on main stream above forks	30	90	600	90 ft. in 1,000 ft. rapids and falls in rock cañon; walls 50-70 ft. high; dam possible at head of falls.
	Koeye Lake creek :				
509	Rapids	80	....	....	River runs in rocky cañon. Lake about 110 ft. above sea. Stated would be difficult to develop.

SOUTH BENTINCK ARM

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Ickna creek :				
510	1st cañon	....	200a	....	200 ft. fall in 1,000 ft. falls and rapids in rock cañon; walls 50-150 ft. high; dam-site at head of falls.
	2nd cañon	....	160b	....	160 ft. fall in about ½m. falls and rapids in rock cañon; dam-site at head of falls.
	Total in 1m.	65	360	4,000	Total fall 360 ft. in about 1m.; includes (a) and (b).
	Talkomei river :				
511	Rapid in cañon (½m. above mouth)	120	65	1,400	65 ft. in ½m. cañon; rock walls 20-60 ft. high; more rapids above.
	Noeick river	240	....	....	Said to have no power sites in lower reaches; has numerous small glacial tributaries.

NORTH BENTINCK ARM

	Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	Bellakula river	2,200x	....	....	Said to be no power sites on main river for 40m. Swift river, bed of pebbles and boulders. Numerous small tributaries afford small powers for several months of year.
	Tastakwan river (trib. Bellakula 1m. above mouth) :				
512	Falls on D.L. 126 and south of D.L. 126	....	800	2,000	Estimated fall of 800 ft. in ½m. Stream descends from elevated valley through series of cañons. 100 ft. head might be obtained by 300 ft. pipe at lower fall.
	Atnarko river :				
513	Rapids below Tenas lake (7m. above Hotharko)	640	....	....	3m of rapids. Storage in Tenas lake. Head not ascertained.
	East Fork Atnarko river :				
514	Rapids, about 3m. below Charlotte lake	130	....	....	Rapids above South fork of Atnarko river; 9m. of rapids.
515	Charlotte lake outlet, fall in rock cañon	....	40	150	20 ft. direct fall in rock cañon, 150 ft. long, 30 ft. wide to smaller lake. Dam at outlet of small lake, in rock cañon, would raise level to Charlotte lake and obtain head of 40 ft.

*See Description of Power Tables.
x Drainage area above mouth.

TYPICAL SMALL MOUNTAIN LAKES
Anne and Joseph lakes on tributary to Indian river. Many small lakes at high elevations may be developed for storage.

STREAM DESCENDING FROM HANGING VALLEY
Mackenzie fall, Hazel creek, Toba valley, 800 feet fall in sight.

TYPICAL VIEW ON COAST STREAM
Power possibilities apparent. Cañon creek, tributary to Toba river.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)

1.0 2.8 2.5 3.2 2.2 3.6 2.0 1.1 4.0 1.8 1.25 1.4 1.6

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Hotharko river (trib. Bellakula):	*	*	*	
516 Rock cañon	50	....	....	Rock cañon about 2m. long. Head not ascertained.
Necleetsconnay river:				
517 Rapids in cañon near mouth	190	100	2,500	100 ft. fall in ½m. Dam-site 1½m. above bridge, rocky banks 50-75 ft. high.
Nicumiamus creek: (North Bentinck arm, 4m. from head on west side):				
518 Falls near salt water	Un-known	....	....	Viewed from salt water an extensive valley is seen with steep descent and waterfalls in places.

DEAN CHANNEL

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Nusash river (on east side):				
519 Rapids in cañon 1m. from mouth	40	110	600	110 ft. in 1m. rapids in narrow, rocky cañon; dam-site about 200 ft. wide at head of cañon.
Dean (Salmon) **river**:				
520 Dam-site 3½m. above mouth	2,800	12	1,200	Possible dam-site at head of cañon, rocky banks; head created by dam.
521 Fall 6m. above mouth of Iltasyouko ‡	1,400	100	2,500	Fall of 80 ft. on main stream, descends by several steps. Below fall, Dean river has numerous rapids; leaving general level of plateau, enters cañon, and in 45m. descends nearly 3,000 ft.
Iltasyouko river: ‡ (outlet of Sigutlat lake)				
522 Falls 1m. above mouth	400	60	1,000	Two falls about 25 ft. each. The upper over bluish feldspathic rock; lower in narrow chasm between perpendicular rocky walls. Probably storage in Sigutlat lake and lakes above.
Kimsquit river	480	....	....	Said to have no power possibilities in lower reaches.
Manitoo creek:				
523 Manitoo Cannery development	Small	215	50	215 ft. head in about ½m.; steep glacial creek; 10 h.p. used by Manitoo Cannery, May to October, plenty of water during these months Small turbine, flume and pipe.
Scowkwits river:				
524 Rapids in cañon	Un-known	230	4,000	230 ft. in 4m. of rapids. Deep cañon starts 2½m. from mouth; possible dam-site 4m. up.
Noscall river:				
525 Noscall falls	Un-known	135	7,000	135 ft. head in 1,000 ft. of falls and rapids in rock cañon. Dam-site above falls; storage in 3 lakes.

DEAN CHANNEL TO GARDNER CANAL

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Link river:				
526 Ocean Falls Co. development	....	110	11,200§	105-115 ft. head developed by 60 ft. dam and 12 ft. dia. steel penstock 776 ft. long. Link lake partially developed for storage. Power for pulp-grinders, saw-mill, power and light. Also steam plant.
Roscoe river: (at head of Roscoe inlet)				
527	Un-known	....	....	Partially examined in lower reaches; no power sites discovered.
River at head of Ellerslie channel:				
528 Rapids below lake	Un-known	170	1,800	170 ft. fall in 1½m. Total head easily developed by flume, etc., and small dam at outlet of lake.
River on west side Ellerslie channel (7m. from head):				
529 Fall at salt water	....	31a	....	31 ft. direct fall.
1st rapids	....	100b	....	100 ft. fall in about 4,000 ft
2nd rapids	....	115c	....	115 ft. fall in about 4,000 ft.
Total in about 1½m.	Un-known	240	2,200	Total fall 240 ft. in about 1½m. from lake to tidewater includes (a), (b), (c). Dam-site 200 ft. below lake, storage in lake.
Matheson channel, East arm:				
530 Several falls near salt water	....	....	....	Inlet is surrounded by steep rugged mountains only partially timbered. Several small tributary streams contain falls at tidewater; the most prominent is on north bank and appears to fall about 200-300 ft. from a "hanging valley." The rivers at the head of inlet are quite small.

*See Description of Power Tables.
†See *Report of the Geological Survey of Canada* for 1876-77, p. 28.
§Total h.p. of turbines installed.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Poison Cove river : (head Mussel inlet)				
531 Fall 1m. from mouth........	50‡	120	2,000	75 ft. direct fall, 45 ft. fall in 600 ft., rapids below. Rocky crest of falls might be raised a few feet to back water up to lake ½m. above. Good storage in lake about 4m. long. Easily developed.
Mussel river : (head of Mussel inlet)				
532 First fall on east branch, 3½m from salt water...........	200x‡ 50‡	400	3,500	200 ft. fall in 500 ft. ; above falls, 210 ft. fall in ½m. box cañon, width 80-120 ft., walls 1[illegible]0-500 ft. high. Good dam-sites, stream flows over bed rock.
Lizette creek (trib. Mussel inlet near N.W. corner) :				
533 Falls at mouth.............	Over 25	400	4,500	410 ft. fall in ½m. from lake to sea level. Natural dam at outlet might be raised to give excellent storage in lake about 1,200 acres area. Easily developed.
M'Alpin creek: (trib. Mussel inlet on west side 2½m. from N.W. corner)				
534 Falls near tidewater........	Over 20	220	1,500	150 ft. direct fall at inlet. Total 220 ft. fall in ½m. from lake to sea level. Additional storage in lake, area about 600 acres, good dam-site at outlet. Easily developed.
Carter river : (head of Finlayson channel)				
Suggested development......	....	....	....	A proposal has been made to develop power on this stream.
Swanson creek (Graham reach) :				
535 Development by Swanson Bay Forests, Wood Pulp and Lumber Co.............	Un-known	132	3,000	132 ft. head developed by wood-stave pipe.
535 Possible total head.........	....	342	8,000	342 ft. possible head from lake to sea level. Intake dam and measuring weir at head of pipeline. Lake about 7m. long by 1m. wide, small control dam at outlet.
Dome river (centre stream at head of Aaltanhash inlet) :				
536 Falls below lake............ (1½m. from mouth)	30‡	180	2,000	90 ft. in ½m. below lake, 90 ft. in rapids below. Good storage in lake 1½m. long, ½m. wide. At outlet, river flows through box rock cañon ; dam would raise lake to any height desired.
Aaltanhash river : (head of inlet)				
537 First fall, 2m. from mouth...	120‡	60	1,600	60 ft. fall in 1,000 ft. falls and rapids. Good dam-site above falls.
537 Second fall, 3m. from mouth	....	75	2,000	75 ft. fall in 1,500 ft. similar falls and rapids. Good dam-site above falls.
537 Third fall about 4m. from mouth..................	....	82	2,200	82 ft. fall in short distance. The above falls might be developed separately or possibly combined. Smooth water between the various falls. Said to be storage possibilities further up stream.
GARDNER CANAL§				
Triumph river : (head of Triumph bay)				
538 Saltchuck falls............	Un-known	90	2,000	85 ft. head in series of falls over boulders in 450 ft. Good dam-site at rock islet above falls. Extensive swamp and lake above falls, would give good storage. Easily developed.
538 Lake fa..................	....	110	2,500	110 ft. in about ½m. below lake over big rock slide in cañon. Good storage in lake 2½m. long by ½m. wide. Lake level might be raised a few feet only. Easily developed. Above lake there are more rapids and falls, but stream divides.
Kiltuish river : (head of Kiltuish inlet)				
539 First falls, 3½m. from mouth.	....	50..	...	Direct fall of 15 ft., balance in ½m. steep rapids.
539 Second falls...............	....	[illegible]	....	Second falls about 300 ft. above first. Good dam-site at head.
539 Total.....................	Un-known	100	2,500	(a) and (b) might be combined to give total head of about 100 ft. ; good dam-site at head of second falls.
Kowesas river :				
540 Tributaries.................	Un-known	....	....	Has no power sites in lower reaches of main stream, but high heads are available on several small tributaries.

*See Description of Power Tables.
‡Rough estimates.
§The winter conditions about the head of Gardner canal may be severe. The canal sometimes freezes over for 25 miles from its head.
x Drainage area above mouth.

MAINLAND PACIFIC COAST DISTRICT No. IV—*Continued*

Stream and Site	Watershed in sq. miles	Head in feet	Horse-power	Remarks
Price river (at Price cove):	*	*	*	
541 Falls at mouth	Unknown	100	500	Fall of 100 ft. in 150 ft. series of falls at mouth. Easily developed. Above falls in deep, box rock cañon with steep side hills. 400 ft. fall in first 1½m., includes falls at mouth. Narrow V-shaped valley.
Kitlope river	300x	....	....	Tide backs water up some 6m.; main river has no power sites below Kitlope lake. Good power might be obtained by developing high heads on many small tributaries. Valley 1 to 4m. wide.
Kemano river	320x	....	....	Main stream flows through low wide valley and there are no power sites below headwaters where stream is small.
Wachwas creek: (trib. Kemano, 5m. from mouth)				
542 Rapids in box cañon ½m. from mouth	Small	265	900	265 ft. fall in 2m. Series of falls and rapids in cañon. Flow unreliable in winter.
Seekwyakin river: (trib. Kemano, 8m. from mouth)				
543 Dam-site in box cañon 1m. from mouth	Unknown	60	600	Head obtainable depends upon height of dam. Low grade in cañon.
Tachastes creek: (trib. Kemano, 10m. from mouth)				
544 Cascades in box cañon	Unknown	200	1,600	145 ft. cascades in box cañon and 55 ft. in rapids below. Said to have good flow in winter. Storage in small lake at head.
Brim river:				
545 Rapids 1½m. from mouth	90	20	400	20 ft. head in ½m. Rapids might be developed by diverting dam and flume. More falls in rapids below and nearer mouth but difficult to develop and proximity of power on tributary "A" would make it unnecessary. Banks low and rocky in places. Side hills steep and rocky.
Tributary "A" (east side Brim river ½m. from mouth):				
546 Falls 200 yds. from mouth	Unknown	300	1,000	Direct fall of about 300 ft.; probably more fall above; not closely examined.
Inlet creek (near Brim river):				
547 1st falls at mouth	Unknown	220	800	220 ft. head in ½m. Excellent dam-site at head of falls, bed rock of diorite on both sides and rock islet in centre. Grade flattens out above, and river flows in narrow valley. Power house might be placed at foot of falls or at mouth of Brim river.
GRENVILLE CHANNEL AND SKEENA ESTUARY				
Kumeolon creek: Suggested development	....	....	....	Stated that 2,500 h.p. is available at certain seasons.
Browns river (trib. Ecstall):				
548 Falls and rapids	40‡	380	7,000	378 ft. fall in 1,500 ft.; dam-site solid granite; storage in Browns lake.
McKnight creek:				
549 Dam-site at outlet lake	....	....	3,000	70 ft. dam proposed.
Madeline creek:				
550 Falls 1m. from mouth	30‡	860	8,000	860 ft. fall in 8,500 ft. Storage in small lake.
Falls river:§ (trib. Ecstall, 18m. from mouth)				
551 Falls near mouth	90‖	245	15,000[1]	Cascade 185 ft. fall in 400 ft., 25 ft. fall only in 4m. above. Ample storage may be developed by dam. Dam-site solid granite. Watershed contains many snowfields and glaciers.
Khatada river:[2]				
552 Proposed development	60‖	350	9,500[3]	280 ft. fall in 1½m. rapids and falls below lake Brutinel, which may be raised to give working head of about 350 ft. and storage to conserve total run-off
SKEENA RIVER AND TRIBUTARIES				
Skeena river:				
553 Kitsalas cañon	15,520	20	15,000	6·4 ft. fall in ½m. rapid water. Channel 200 ft. wide lower end, to 80 ft. at upper end. West bank 80-100 ft. high; east bank 30-50 ft. Would be difficult to develop owing to natural conditions and proximity of G.T.P. Ry. tracks.

*See Description of Power Tables.
‡Estimated.
§See page 175.
‖Surveys by Ritchie, Agnew & Co.
[1]Suggested development contemplates installation of 24,000 h.p.
[2]See page 176.
[3]Suggested development contemplates installation of 18,000 h.p.
x Drainage area above mouth

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Skeena river (continued):				
554 Cañon at Four-mile bridge... (just north of Hazelton)	9,200	27	9,000	4 ft. direct fall, making total of 7·5 ft. in 1,000 ft. rapids. Possible 20 ft. dam at head. Would create good pondage. Walls of hard rock rise 50 ft. sheer.
555 Old Kuldo cañon........... (20m. above Babine river)	4,000	40	5,000	2 ft. direct fall, making total of 10 ft. in 1,300 ft. rapids. Rock walls 40 ft. sheer, 75 ft. apart. Possible head of 40 ft. includes proposed 30 ft. dam.
556 Big Slide cañon............ (2m. south of 3rd Telegraph cabin)	3,700	35	4,000	5 ft. fall in 1,000 ft. rapid. West wall 40-65 ft. sheer, east wall rises at angle of 65°. Possible 30-40 ft. dam.
557 Fourth cañon.............. (9m. above 4th Telegraph cabin)	3,140	50	5,000	3 ft. direct fall and 8·6 ft. in ½m. rapids. Total head about 50 ft. with possible dam of 40 ft. Dam would create good pondage. Narrow cañon 60-75 ft. wide, hard rock walls 20-40 ft. high, steep slopes above.
Williams creek: (trib. Lakelse lake)				
558 Site 5m. above Lakelse lake..	Small	....	....	Proposed utilization by Lakelse Development Co.
Kitsumgallum river: (trib. Skeena)				
559 Cañon 5-11m. above mouth..	400	50–60	6,500	Rock cañon about 6m. long. Average width about 60 ft., minimum 25 ft., perpendicular rock walls 60-90 ft. high, river bed much broken up by rock ledges forming rapids. Head optional, depending on height of dam. Several dam-sites, storage in 3 lakes.
Zymoetz river (trib. Skeena):				
560 Cañon 4-6m above mouth...	1,100	50	7,500	Cañon average width 85 ft., minimum 67 ft., precipitous rock walls 70 ft. high. Head optional, depending on height of dam.
Granite creek: (trib. Zymoetz river)				
561 Falls near mouth...........	Unknown	200	200	Two direct falls affording 200 ft. head. Small creek, precipitous granite walls over 100 ft. in height. Storage in small lake.
Kleanza (Gold) **creek**: (trib. Skeena)				
562 Rapids in cañon 2½m. above mouth..........	90	50	600	6 ft. direct fall at head and 14 ft. fall in rapids, in box cañon 500 ft. long, rock walls 70-100 ft. high. Good dam-site in cañon. Head optional, depending on height of dam. Good pondage might be created above dam.
Lorne creek: (129 m. above mouth of Skeena)				
563 Dry Hill Hydraulic Mining Co. development.........	....	....	....	Small hydraulic mining plant. 2½m. flume and 6-inch monitor; 1,000 miner's inches.
Juniper creek (trib. Kitseguekla):				
564 Montana Continental Development Co., power development (4m. from mouth)...	40	180	250	212 ft. static head. 180 ft. effective head developed by 3,780 ft. wood-stave pipe 18-24 in. dia.; 54 in. dia. Pelton wheel belted to 187-k.v.a. alternator; no storage. Timber crib diverting dam 6 ft. high, 40 ft. long.
Bulkley river:				
565 Hagwilget cañon	4,520	120–135	20,000	This head would involve 80 ft. dam near old Indian bridge and include 59 ft. fall in 3m. rapids below. Cañon 10m. long with precipitous rock walls 180 ft. high. Head optional, depending on height of dam. 80 ft. dam would cause no trouble by back-flooding, as cañon extends 6m. above dam-site.
566 Beament cañon............	3,920	60–70	7,500	60 ft. fall in ½m. rapids in cañon. Dam-site at upper end of cañon 40-50 ft. wide. Rock walls 12-15 ft. high.
567 Moricetown falls...........	3,740	90–95	9,500	13 ft. direct fall at head of cañon, 21 ft. in ½m. rapids above, 43 ft. in 1½m. rapids below. Cañon 25-53 ft. wide. Perpendicular rock walls 125-150 ft. high below fall. If natural head were increased more than 15-20 ft. would flood valuable land.
568 Cañon (37m. above Hazelton)	3,600	75	8,500	48 ft. fall in ½m. rapids in rock cañon. Suggested 30 ft., possibly higher, dam at head of cañon. Walls about 200 ft. high.
569 Suggested development at dam-site ½m. below Driftwood creek.............	3,550	20	2,200	Dam-site at island 400 ft. above sec. 25, tp. 1a, R. V. Two dams, each about 125 ft. long, required.
570 Rapid at Telkwa...........	3,480	20–23	2,200	13 ft. fall in ½m. rapids. Total head, with 10 ft. dam, 20-23 ft.; low banks with rock outcrop in places. Proximity of railway might make development difficult. River about 200 ft. wide.
Two-mile creek (trib. Bulkley):				
571 Cascades near mouth.......	10	280	125	Small creek; 280 ft. fall in 4,000 ft. More head above rocky bed; glacier fed.

*See Description of Power Tables.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Suskwa river (trib. Bulkley) :	*	*	*	
572 Black cañon, 10m. up East fork	Un-known	100	300	40 ft. fall in two falls, one at upper and one at lower end of cañon. Cañon about 400 ft. long, 20-40 ft. wide, walls of solid rock 100-200 ft. high. Dam might be erected to increase head to 100 ft. or more.
Mud creek (trib. Bulkley, 11m. above Hazelton) :				
573 Rapids near mouth	15	220	300	220 ft. fall in 1m. ; more head higher up
Porphyry creek (trib. Bulkley, 17m. above Hazelton) :				
574 Rapids above mouth	20	150	300	150 ft. fall in ½m. rapids; more head higher up. Boulder-strewn bed.
Boulder creek (trib. Bulkley, 21m above Hazelton) :				
575 Rapids near mouth	Un-known	250	500	250 ft. fall in 1m. rapids between waggon road and mouth. G.T.P. Ry. crosses at cañon ½m. above mouth.
Reiseter (Two Bridge) **creek** (trib. Bulkley at 37m. cañon) :				
576 Cascades near highway bridge	Un-known	130	100	110 ft. fall in 1,400 ft. rapids. Deep rock cañon with perpendicular granite walls 95 ft. high ; dam-site at head ; width at water surface 60 ft.
Driftwood creek (trib. Bulkley, 46m. above Hazelton) :				
577 Cascades near mouth	Un-known	150	150	130 ft. fall in 1m. cascades. Dam-site near highway bridge ; dam 20 ft. high, would form small pondage. Cañon of shale rock with steep sides 32 ft. high, width at bottom 22 ft., top 68 ft.
Carr (Cañon) **creek** (trib. Bulkley, 50m. above Hazelton) :				
578 Rapids near mouth	Un-known	300	100	About 300 ft. drop in 3m. rapids below. Dam-site at head of box rock cañon, 100 yds. below highway bridge. Dam 50 ft. high might be built.
Telkwa river (trib. Bulkley) :	460x			
579 Dam-site 5m. from mouth	475	15	200	Dam-site with rock outcrop on each side of river rising to height of 15 ft. Side hills slope back to height of 100 ft. Pondage created by dam would be confined to river channel.
580 Cañon ½m. below Pine creek	390	35–40	500	20 ft. fall in 700 ft. rapid. Cañon walls precipitous volcanic rock, west wall 200 ft. sheer, east wall 180 ft. high slopes angle 65°. Cañon 400 ft. wide at bottom. Gravel flats at head of cañon would give good pondage.
Goat creek (trib. Telkwa, 5m. above mouth) :				
581 Rapids near mouth	50‡	75	120	75 ft. fall in ½m. between highway bridge and mouth. Gravel bed and banks. More head further up.
Pine creek (trib. Telkwa) :				
582 Cañon ½m. from mouth	50	50	100	Cañon 300 ft. long, rock walls 130 ft. high at upper end. Good dam-site. Dam might be raised to 100 ft., giving good pondage. 30 ft. fall in ½m. between dam-site and mouth of creek.
Howson creek (trib. Telkwa) :				
583 Falls at mouth	28	100	100	Two falls 26 and 6 ft. Dam-site 50 ft. above main falls ; dam 75 ft. high would give about 23 acres storage and drown out upper fall. Cañon at dam-site 15 ft. wide at bottom and about 105 ft. wide at 75 ft. elevation.
Maclure (Aldermere) **lake** :				
584 Outlet	14y	75	....	69 ft. fall in ½m. Lake 2½m. long and 1½m. wide. Low dam might be built at outlet, discharge very small, but might be used for water supply to Telkwa or small lighting plant.
Morice river :				
585 Cañon, 21m. from mouth	1,500	40	5,000§	Cañon 600 ft. long, precipitous rock walls rising from zero at head of cañon to 50 ft. on east and 30 ft. on west banks where width is about 80 ft. Dam might be built 35 ft. high to give good pondage, 5 ft. fall in 500 ft. rapids below dam-site.
Kispiox river :				
586 First cañon, 31m. from mouth	Un-known	20	150	About 6 ft. fall in 400 ft. Good dam-site in cañon. Rock walls 20 ft. on south side, 30-40 ft. high on north side. Cañon 50 ft. wide with rock islet in centre, reducing channel to 30 ft. wide. Dam 12-15 ft. would form good pondage. Above and below cañon river widens out with considerable flat land.
587 Second cañon, 40m. from mouth	Un-known	20-26	150	6 ft. fall in 1,500 ft. rapids with two small falls. Dam 20 ft. high would form good pondage, banks of shale with rock islet in centre. Good dam-site.

*See Description of Power Tables.
‡Above mouth of Tenas creek.
§Assumes the provision of some storage on lakes above
x Drainage area above mouth. y Drainage area above lake outlet.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
Peavine creek (trib. Kispiox) :	*	*	*	
588 Falls near mouth	Un-known	140	50	Two direct falls of 33 and 31 ft. and cascade of 66 ft. Soft shale banks 20-70 ft. high. Reported lake at source.
Dead Horse creek (trib. Skeena 2½m. south of 2nd cabin) :				
589 Falls near mouth	Un-known	125	50	Direct fall of 75 ft. and cascade 35 ft. in 300 ft. Dam-site ½m. from Skeena. Banks of soft shale 15-80 ft. high.
Kuldo creek: (trib. Skeena at 2nd cabin)				
590 Cañon near mouth	Un-known	25–30	150	3 ft. fall in 700 ft Good dam-site in cañon 30 ft. wide. Walls of rock up to 20 ft. high.
Driftwood creek (trib. Skeena 6m. above Old Kuldo) :				
591 Fall and rapids near mouth	Un-known	170	450	Direct fall 25 ft., cascade 125 ft. fall in ½m. Rocky banks 20-50 ft. high. Dam-site near Telegraph trail.
Big Slide creek: (trib. Skeena near 3rd cabin)				
592 Falls near mouth	Un-known	200	300	Four falls totalling about 70 ft. and 120 ft. fall in 2,000 ft. rapid. Narrow rock cañon, banks 75-100 ft. high, more head above.
Cañon creek (trib. Skeena 4m. south of 4th cabin) :				
593 Falls and rapids in cañon near mouth	Un-known	100	500	12 ft. direct fall and 58 ft. in 2,100 ft. rapids in narrow, rocky cañon, walls 200 ft. high.
Galanskeast creek (trib. Skeena) :				
594 Cañon near mouth	Un-known	25	250	Fall of 12 ft. in rapids and small fall in rock cañon 600 ft. long and 75 to 90 ft. wide. Good dam-site. Valley widens above cañon.
Kastberg creek (trib. Bear lake) :				
595 Falls, 15m. from mouth	Un-known	40	50	Direct fall of 20 ft., 15 ft. fall in 1m. rapid above and similar fall below. Rocky banks 30 ft. high above crest of falls. River 25 ft. wide at cañon.
NORTH OF SKEENA ESTUARY				
Wolf creek (between Porpoise lake and harbour) :				
596 Prince Rupert Hydro-Electric Co. development	Small	250	....	254 ft. fall in 1m. Storage by 30 ft. dam on small lake on Lot 691.
Woodworth river :				
597 Prince Rupert development	9.56	300	1,650‡	Developed in connection with domestic water supply for Prince Rupert.
Thulme river :				
598 Falls and proposed development	....	315	10[illegible]	[illegible] direct fall, 315 ft. total in 800 ft. Proposed 30 ft. [illegible] give 6,000 acre-feet storage.
Union creek :				
599 Falls and rapids	Small	400	[illegible]	[illegible] proposed by Pacific Pulp and Power Co. [illegible] in Union lake.
OBSERV[illegible]				
Stream, at Mill bay :				
600 Development by Kincolith Packing Co.	Small	330	180	Small development for operation of canning plant. Three small lakes provide storage, an 18 ft. dam at outlet of one lake and 10 ft. dam at outlet of lowest lake. 2,000 ft. pipe-line to cannery. Three 30 h.p. and one 90 h.p. Pelton wheels installed.
Nass river : ‖				
601 Falls on main river 3m. below Cranberry river	7,200	100	20,000	Direct fall of 60 ft. ; possible total of 100 ft. in 1m. Head estimated.
602 Falls, 12m. above Cranberry river	6,250	40	6,500	18 ft. direct fall ; possible total 40 ft. ; falls occur in narrow box cañon with walls of sedimentary rock about 100 ft. high. At high stages river rises considerably. Drift logs were noticed 75 ft. above low water level. Would be difficult to develop.

*See Description of Power Tables.

‡Horsepower of unit installed.

§Proposed future development for Prince Rupert. It has been stated that 25,000 h.p. plant may be installed with continuous power available of 10,000 h.p.

‖The greater part of the Upper Nass river flows through box cañons, where there are several quiet stretches, especially at low stages. By placing several dams in these cañons it would probably be possible to utilize the entire fall between the Blackwater and the village of Ayansh ; this is estimated at about 800 ft. Owing to the great difference in elevation between high and low water in the cañon, the problem of developing this river would be a difficult one. The table indicates the most favourable points, but the heads given are suggestive rather than definite.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq.miles	Head in feet	Horse-power	Remarks
	*	*	*	
Nass river (continued) :				
603 Rapids and falls 2¾m. below White river	5,400	35	5,[illegible]00	Direct fall 15 ft., 20 ft. fall in ½m. rapids. Dam about 35 ft. high possible at falls. Good rock walls. Power-house site would have to be blasted out.
Rapids and falls 2m. below White river	....	125	20,000	10 ft. direct fall and 115 ft. in 2m. rapids. High rock banks. Dam could be raised 40 ft. at falls, giving 50 ft. head ; or 30 ft. at head of rapids, giving 145 or 150 ft. head. Power site would have to be blasted out of solid rock. Any development here would have to be considered in connection with previous site.
604 Rapids, 8m. above Mesiadin river	4,700	40	5,000	40 ft. fall in ½m. rapids. High banks of soft rock. Dam might be raised 60 ft. without damage by back flooding. Power-site short distance below rapids.
605 Upper rapids, about 10m. above Mesiadin river	4,700	40	5,000	40 ft. fall in ½m. rapids. High banks of soft sedimentary rock. Dam might be raised 60 ft. without back-flooding.
Tseaxe river (trib. Nass river) :				
606 Falls 5m. above mouth	120	30	100	15 ft. fall in steep cascade, 10 ft. in 200 ft. rapids below. Stream for 12m. above mouth confined to shallow channel by lava flow. Probably greater head could be obtained.
Seaskinnish creek : ‡				
Fall 4m. above mouth	....	12	....	Direct fall of about 12 ft.
Quinamuk creek : ‡				
Several falls near mouth	....	....	....	Impassable by salmon. Lake above, about 1½m. dia.
Quinetawl creek : ‡				
Cañons and rapids	....	....	....	Turbulent stream flowing between narrow rocky walls ; impassable by salmon.
Clearwater creek : ‡				
Falls and rapids near mouth	....	....	....	Said to be falls and rapids near mouth which hold back the salmon.
Taschitin creek : ‡				
Cañons	....	....	....	Swift-running stream flowing through rocky cañons.
Kinskooch river :				
607 Fall at head of cañon 1m. from mouth	250	60	400	Direct fall about 60 ft. Slate rock cañon, about ½m. long, below, 70 ft. deep, 60 ft. wide at head.
Cranberry river (trib. Nass) :				
608 Falls on North fork 7m. above forks	400	25	200	15 ft. direct fall, 10 ft in rapids below; low banks above falls. Perpendicular rock below for 300 ft.
Brown Bear creek : (trib. Nass, 50m. above mouth)				
609 Falls 1m. above mouth	240	30	[illegible]	Direct fall of 20 ft., 10 ft. in 650 ft. rapids below ; perpendicular rock walls 20 ft. high.
Meziadin river :				
610 Falls about 1m. from mouth §	200	20	500	Cascades with head of 20 ft. Storage by 12 ft. dam at Meziadin lake (Canadian North Eastern Power Co.).
Vile creek (trib. Nass, 60m. above Meziadin) :				
611 Rapids in cañon 2-3m. from mouth	Un-known	50	50	Estimated fall of 50 ft. in 2½m. Creek 30 ft. wide, flows in box cañon 150 ft. deep.
Anthony creek : (Ground Hog district)				
Rapids and falls	Un-known	....	....	Small creek 6m. long, falls 1,600 ft.
Falls creek (Granby bay) :				
612 Development by the Granby Consolidated Mining, Smelting and Power Co.	40	375	7,000‖	375 ft. head developed by rock fill dam 115 ft. high in box rock cañon at bend, about 1½m. from mouth, and about 5,800 ft. of wood-stave and 120 ft. of steel pipe-line. Ten Pelton-Doble wheels from 3-24 ft. dia. drive generators, blowers, compressors, hauling machinery, etc., and supply light and power for all mining requirements and to town of Anyox. Further storage dams are contemplated higher upstream. See page 160.

*See Description of Power Tables.
‡See *Annual Report of the Commissioner of Fisheries*, British Columbia, for 1914, p. N43 and 44.
§A good fishway has been constructed round these falls, see *Annual Report of the Commissioner of Fisheries*, British Columbia, for year 1913, p. R51. See also Plate 2.
‖Horse power of plant installed.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
PORTLAND CANAL				
Glacier creek : (3½m. north of Stewart)	*	*	*	
613 Development by Portland Canal Mining Co.	....	100	....	100 ft. head developed for mining purposes by 1,100 ft. flume 3 ft. by 4 ft. Two 6 ft. and one 3 ft. Peltons, also electric generator.‡
American creek (trib. Bear river, head of Portland canal) :				
614 Suggested development	....	....	....	Proposed development in connection w[illegible] mining activities.
Cascade creek (trib. Salmon river, head of Portland canal) :				
615 Suggested development above International boundary	....	....	....	Stated that over 1,000 h.p. might be developed at certain [illegible]
BEHM CANAL				
Unuk river :§				
616 Reported power sites	Unknown	....	....	Said to be ample water-power on this stream for local mining or electric railway requirements.
Stikine river : ‖				
617 Little cañon	15,400	....	....	Narrow, deep, rocky gorge, ½m. long, in places not more than 150 ft. wide, massive granite cliffs 200-300 ft. high.
618 Klootchman cañon, 8m. above Little cañon	14,800	....	....	Similar to Little cañon, but offers no impediment to navigation ; 300 ft. wide.
619 Grand rapid	14,500	....	....	4m. above Klootchman cañon ; river wide and shallow.
620 Great cañon (above Telegraph Creek)	11,700	....	....	Extends for many miles, banks often 300 ft. high.
First South fork :				
621 Rapids in gorge	650x	....	....	Flows in narrow gorge for several miles from mouth.
Tahltan river (trib. Stikine) :				
622	400x	....	....	Large rapid stream. Valley is narrow and almost cañon-like where it reaches the Stikine.
Tuya river (trib. Stikine) :				
623 Steep rapids in deep gorge	1,360x	....	....	At trail crossing near mouth, river is a wild torrent, almost a series of cascades, in a deep gorge 600 ft. deep cut out of the terrace deposits.
ATLIN DISTRICT	....	....	....	Several streams with steep grade are said to afford power possibilities in all parts of the Atlin district. Most of the streams are fed from permanent ice and snow fields. Plants are projected at several points.[1]
Pine creek (near Atlin)	....	....	....	Said that falls and rapids on Pine creek would afford ample power for mining requirements in district.
PRINCESS ROYAL ISLAND[2]				
Wark lake :				
624 Wark Island falls	Unknown	300	3,000	290 ft. head in abou[illegible] om lake to salt water. Storage might be create[illegible] [illegible]-10 ft. dam at outlet of lake. 8-10 sq. m. area. [illegible]ast part of falls at salt water. Partially developed [illegible] Butedale cannery by pipe-line 1,200 ft. long, and small Pelton wheels. Proposed to develop more power for cold storage purposes. Very easily developed.

*See Description of Power Tables.

‡See *Annual Report, Minister of Mines*, British Columbia, for 1910, p. 75.

§See *Annual Report, Minister of Mines*, British Columbia, for 1911, p. 67.

‖For description, etc., see *Report of the Geological Survey of Canada*, Volume III, Section B. p. 46, etc. The river is navigable by stern-wheelers from its mouth to Telegraph Creek. Several glaciers occupy side valleys coming right down to the river flats. Above Telegraph Creek the Great cañon commences and the river becomes rough and rapid, but there are said to be no true falls.

[1]See *Annual Report Minister of Mines*, British Columbia, for 1900, p. 777, and 1904, pp. 74, 76, 91.

[2]Princess Royal island is very mountainous and has a number of good small power possibilities. In the northern portion of the island there is a long lake discharging toward the west, but its eastern extremity is said to be only a few hundred yards from salt water and it is only kept from discharging eastwards by a narrow ridge which could easily be tunneled and power developed on the eastern side of the island.

Further south Butedale cannery has a pipe line from the top of Wark Island falls and develops small power under a head of about 300 ft. Storage might easily be provided by damming the lake at the head of the falls.

A little north of Swanson bay, but on Princess Royal island, there is a fall which drops in a series of cascades about 2,000 ft. from a small lake above. The storage and discharge would be small but the high head would give a good small power.

There are several other small powers on this island.

x Drainage area above mouth.

SKEENA RIVER—HEAD OF KITSALAS CAÑON
On main stream above confluence of Zyometz river.

BULKLEY RIVER—HAGWILGET CAÑON
Near Hazelton. A possible power site.

MAINLAND PACIFIC COAST—DISTRICT No. IV—*Continued*

Stream and Site	Water-shed in sq. miles	Head in feet	Horse-power	Remarks
	*	*	*	
Surf inlet (on west side island) :				
625 Falls at outlet of Cougar lake at head of inlet ‡ (Development by Surf Inlet Power Co.)	16½	73	2,000	30 ft. falls at outlet of Cougar lake, one of a chain of lakes which, with short portages, gives easy access to a large section of the interior. 73 ft. head developed by hollow-type reinforced concrete dam 430 ft. long, 74 ft. high, 450 ft. from power house. 2 Peltons, 630 h.p. each.
QUEEN CHARLOTTE ISLANDS				
Hancock (Kawon) **river** : (Masset harbour)				
626 Suggested development	....	....	....	A development has been proposed on this stream; said that 650 h.p. is available at certain seasons.
Ain river (trib. Masset inlet) :				
627 Rapids between Ain lake and mouth	[illegible]	150	3,500	150 ft. fall in 2m. rapids below Ain lake. Power-site ½m from mouth. Storage in Ain lake, area about 8 sq. m.
Mountain river : (trib. Rennell sound)				
628 Falls and rapids 1½m. from mouth	Small	1,000	950	Small creek, proposed development by Rennell Sound Development Co.
Raney river (trib. Rennell sound):				
628 Falls and rapids ¾m. from mouth	Small	450	450	Small creek, proposed development by Rennell Sound Development Co.
Twin river (trib. Rennell sound) :				
628 Falls and rapids ½m. from mouth	Small	500	300	Small Creek, proposed development by Rennell Sound Development Co.

*See Description of Power Tables.
‡See *Annual Report Minister of Mines*, British Columbia, for 1912, p. 100.
§Estimated by company.

CHAPTER XIV

Mackenzie River and Tributaries—Topography and Power Site Tables

THE great Mackenzie river, named after the intrepid explorer, Sir Alexander Mackenzie, ranks among the first dozen rivers of the world, and, on the North American continent, is second only to the Mississippi. The Mackenzie river drains a watershed of about 680,000 square miles. Two of its chief tributaries, the Liard and the Peace, drain a large portion of northern British Columbia, and, together with the upper waters of the Hay river, constitute, for the purposes of this report, District No. V. The area of British Columbia which contributes waters to the Arctic ocean is about 106,800 square miles. The Liard drains about 98,000 square miles, of which some 53,000 square miles is in British Columbia. The Peace drains about 110,000 square miles, of which 43,900 square miles lie west of the inter-provincial boundary.

This district may be discussed under two main sub-divisions, one, the area east of the Rocky mountains, which includes the well-known Peace River district ; the other, that lying west of the Rocky mountains, which includes the valleys of the Parsnip and Finlay and their southerly tributaries, also the Liard and its tributaries farther north. The part east of the Rocky mountains is an almost level plateau with a slight dip to the valleys of the Peace and Smoky rivers. Owing to the depths of the valleys below the general level of the plain the conditions for drainage are excellent. The country is largely prairie and poplar copse, and the soil is good. The Peace River district probably comprises the largest consolidated area of agricultural land in British Columbia. The climate is favourable and resembles that of Alberta west of Edmonton. In summer the longer day compensates for the high latitude. The winters are more severe than farther south. For detailed description of this district, the reader is referred to the various Geological reports and accounts of travels in this district. (See Bibliography.)

In a country so comparatively level, water-powers are naturally not abundant. The only large power known is that on the Peace river, commonly referred to as the Peace River cañon. The difference in elevation between the upper and lower ends of the cañon has not been ascertained by levelling, but a careful measurement by Mr. Leo G. Denis, of the Commission of Conservation, with an aneroid, indicates a difference in level of 225 feet in a distance of 18¼ miles. The cañon is in the form of a horseshoe bend, the portage across being abou. 11 miles. Mr. Denis states that :

"The descent of the water in the cañon is fairly uniform, except near the head, where there is a fall of approximately 25 feet in one-half mile. This latter descent is concentrated at two chutes over ledges; one is situated at the head of the cañon and the other one-half mile below, with rapids intervening.

The narrowest point in the cañon occurs at its head, where the distance from bank to bank is only 200 feet."*

The cañon constitutes a power possibility of considerable magnitude and may some day supply the light and power needs of a large portion of the Peace River district. No particulars are as yet ascertainable of any other large water-powers in British Columbia east of the Rockies. No doubt there are several streams rising on the eastern slopes which may yield powers, but, at present, much of this country remains unexplored.† The precipitation on the eastern flanks of the mountains in this district, though sufficient for agriculture, is not heavy.

The district west of the Rocky mountains, for the most part, is very mountainous. The Parsnip, Finlay and Kachika rivers occupy here the continuation of the Intermontane valley, the Parsnip and Finlay at their junction forming the Peace river. The continuity of the west wall of the great valley is broken near the Parsnip, while, to the north, the range re-forms and is known as the Cassiar mountains. The following are the chief streams of this district and, a brief description of their characteristics, so far as known.

Parsnip River

The Parsnip rises near the headwaters of Bad river, a tributary of the McGregor river. This stream was first ascended by Sir Alexander Mackenzie in 1793. He missed the other branch of the Parsnip, Pack river, which, by way of Giscome portage, forms a much travelled route and offers a very much easier passage to the Fraser river. From Mackenzie's description the Parsnip probably rises in true glaciers among high mountains. Below its junction with the Pack river, however, it flows smoothly between low banks through generally level country. In places the banks rise to a height of 80 to 100 feet, showing steep slopes, composed of sand, clay and gravel. For some 10 or 15 miles, midway between the mouth of the Pack and the Nation, the channel is much cut up by islands and sloughs. Most of these are dry at low water and large timber jams generally occur where they branch off from the main stream. Reports respecting its agricultural possibilities differ considerably, yet the country bordering the upper Parsnip is not considered of great agricultural value, as it consists largely of gravel terraces covered with small growth.

**Water Powers of Manitoba, Saskatchewan and Alberta*, by Leo G. Denis and J. B. Challies, Commission of Conservation, Ottawa, 1916, p. 239. See, also, *Report of Geological Survey of Canada* for 1875-76, p. 47 ; estimate of fall from the upper to the lower end of cañon given as 270 feet based on several barometric (aneroid) observations. Also, *Canada on the Pacific*, by Charles Horetzky, Montreal, 1874, pp. 61 and 239 ; difference between head and foot of cañon, result of careful aneroid measurement, given as 240 feet. For other descriptions of cañon, see *Voyages from Montreal through the Continent of North America*, by Alexander Mackenzie, London, 1801, pp. 167-180 ; referring to this portage, Sir Alexander Mackenzie, on page 392, says : "We soon after came to the carrying place called the Portage de la Montagne de Roche . . ." Consult also, *Peace River, a Canoe Voyage from Hudson's Bay to the Pacific, by the late Sir George Simpson in 1828; Journal of the late Chief Factor, Archibald McDonald;* Edited with notes by Malcolm McLeod, Ottawa, 1872; See pp. 19 and 88 ; Also, see *Wild North Land*, Captain Butler, Chapter xxi, p. 249, and *New Rivers of the North*, Hulbert Footner, New York, 1912, pp. 123 *et seq.*

† See "Exploration Survey in Peace River District and North of the Peace River Block," in *Annual Report of Minister of Lands*, British Columbia, for 1914, pp. D90-D95 ; also for 1915, pp. B117 *et seq.*

The Parsnip river, besides Pack river, has two other important tributaries —the Nation and Misinichinka. The last named leads to Pine River pass. The lower portion of the Misinichinka is tortuous and not very rapid, with swampy flats covered with black spruce and other lowland growths on the inner sides of its bends. The opposite side is usually formed of the scarped edge of a gravelly terrace, these terraces being covered with western scrub pine of small size. There is no water-power on the river below the point at which the trail leaves the river to follow up the Atunatche. Above the Atunatche the Misinichinka is a mountain stream.

Nation River

The main valley of the Nation extends east and west for about 60 miles. With its numerous tributaries, it drains a very extensive area, much of which is available for agriculture and can be cleared at relatively low cost. The width of the valley varies considerably. Indications are that, until comparatively recently, the district was heavily timbered. Large areas have been reforested, leaving strips of the original coniferous growth, principally along the shores of the lakes and in patches on the surrounding mountains and hills. Spruce predominates, with a generous proportion of lodgepole pine and some balsam. The general elevation of the plateau is about 2,500 feet, or about 100 feet above the Nation lakes. Excellent and well distributed water supplies exist, but, as a rule, the creeks are not adapted for the economical development of water-power. The main stream, from its mouth to the lakes, has not been examined for water-powers. There are said to be some rapids and a cañon, but it is not known whether either is suitable for development.

Finlay River

Between latitude 56° and 58° N., the great Intermontane valley is traversed by the Finlay river. The valley is six to eight miles in breadth and contains much good land, which is flat-like up to the mountain ranges, paralleling the valley. Originally, it was heavily timbered, spruce predominating. Large areas have, however, been burnt and reforested with lodgepole pine, poplar, willows and some birch.

The region of the Finlay and its branches is characterized throughout by its mountainous character, and, with the exception of the narrow flats bordering the main stream, no plains of any magnitude are known. The eastern tributaries drain the western slope of the Rocky mountains proper. The western branches head in a confused medley of mountain ranges with a fairly uniform height of about 4,000 feet above the valleys, and lying to the east of the Tatla lake and its feeders. They may be regarded as the southern extension of the Cassiar range. Commenting on the mountainous character of this part of the province, Mr. R. G. McConnell says : "The most notable feature of the country in the latitude of the Omineca and Finlay rivers, or from latitude 55° 30′ to latitude 57° or beyond, is its universal mountainous character. In this latitude, the whole country, from the eastern edge of the Rocky mountains westward to the Pacific ocean, is destitute of plains of any considerable extent and, with the exceptions of the breaks where the region is crossed by the valleys mentioned above, is covered with a succession of mountains and mountain ranges varying in height from 3,000 to 5,000 feet above

the valleys. In no other part of British Columbia is the country so persistently mountainous across the whole Cordilleran belt."*

The Finlay river, named after John Finlay, who ascended it in 1824 in the interests of the North West Company, is much larger than the Parsnip, and may be regarded as the upper portion of the Peace. It is 310 miles long and, in the navigable portion, averages 250 yards in width. Except in passing through Deserter cañon, the river is easily navigable for 140 miles above its mouth. It is continually changing its channel—in many cases there are several channels and long sloughs which extend for miles. Large piles of driftwood are a characteristic feature. For 15 miles above the mouth of the Ospika the current is slack, elsewhere it would average, say, three miles per hour, and seldom exceeds five miles an hour. From the mouth to Deserter cañon, 90 miles, there are no rapids, and navigation by light-draught steamers would be comparatively easy at all stages of the water. Farther up, it is interrupted by a long succession of cañons and rapids. Its branches interlock with tributaries of the Skeena, the Stikine and the Liard, and low passes through the mountains from one basin to another are not uncommon.

Deserter cañon is about one-half mile long, through hard conglomerate and sandstone, and, at its narrowest part, scarcely exceeds 150 feet in width. The walls are not very high, except at the lower end, where there is a steep cliff. The channel is crooked and interrupted by several bad rips. At certain stages the cañon can be run, but its navigation is dangerous. A good portage track has been cut out on its west bank. For nearly 50 miles above Deserter cañon the main stream continues to occupy the great Intermontane valley, but above its junction with the Tochieca it breaks through the range bordering the west side of the valley. Twelve miles above this gap its navigation, except at very low water, is stopped by the Long cañon. For five miles the river is a succession of cañons, rips and rapids and frequently narrows to less than 100 feet. The Finlay rises in Thutade lake. For the first four miles after leaving Thutade lake it flows in a cañon, which ends in a fall with a drop of 50 to 60 feet with swift water above and below. (See Plate 34.)

Omineca River

Omineca river came into prominence in 1868 by the discovery of gold on one of its tributaries. Miners flocked into the country, and for some time the population was estimated at 1,200 to 1,500. It reached its zenith about 1879, but as the yield of the creeks became exhausted the enterprise has gradually declined. The Omineca joins the Finlay from the west about 15 miles above its mouth, and is by far its largest tributary, apparently carrying about one-fifth of the water of the main stream. From its mouth to the Black cañon, a distance of about five miles, the current is extremely swift and the river shallow, the slope of the stream exceeding 10 feet per mile. Numerous gravel bars and islands, covered in places by huge drift piles, obstruct the course of the stream, dividing it into several channels.

* "Report on an Exploration of the Finlay and Omineca Rivers," by R. G. McConnell, B.A., *Report of the Geological Survey of Canada*, 1894—Vol. VII, p. 13 c.

The Black cañon is about one-half mile in length and varies in width from 100 to 200 feet. Its walls are usually vertical and in places exceed 150 feet in height. This cañon is said to be easily navigable by canoe at low water but impossible to navigate at flood. From the Black cañon to a point nine miles above the Little cañon, a distance of about 30 miles, the river has a grade of about 12 feet per mile, the difference in elevation being about 370 feet. From the head of the rapid water to Germansen landing, a distance of 12 miles, with the exception of a few small ripples the current is easy, from two to three miles an hour. Slack current continues nearly to New Hogem, a distance, measured along the valley, of about 23 miles. The river by its tortuous channel is considerably more. Above New Hogem the river enters a granite area and a rapid current is again encountered.

The character of the country through which the Omineca flows, with the exception of a few miles at its mouth, is everywhere mountainous. The valleys and the lower slopes of the ranges are, as a rule, densely timbered with evergreens so prevalent in the north. The timber line in this region seldom ascends beyond an elevation of 5,200 feet. The Omineca has one large tributary, the Mesilinka, a swift river with many rapids, and one cañon—Dog cañon—a mile from the mouth. Tributary to this is Tutizeka river, on which a water-power possibility is reported below Tutizeka lake. Another large tributary of the Finlay river is the Ingenika river, but recently investigated. This river rises near the headwaters of the Finlay, its source being within a mile of a small creek which flows into Thutade lake, which is the source of the main Finlay river. The Ingenika river has a length of over 150 miles and several tributaries, of which the most important is the McConnell creek. The main stream has been ascended from its mouth, which is 80 miles above the junction of the Parsnip and Peace rivers, for about 100 miles ; above that point the bed of the stream becomes too rough even for canoes. (See Plate 34.)

The water-power possibilities of the country drained by the tributaries of the Mackenzie river may be said to be practically unknown. The sparse information available has been culled from reports by various explorers and surveyors, the best being the accounts contained in the reports of the Geological Survey of Canada. The character of the main streams is fairly well known, though, where a cañon occurs, it is seldom possible to determine from the reports whether it would form a suitable dam-site. The available possible heads have not been measured. There is little doubt, however, that in a country with the above described characteristics, there must be a large number of streams on which water-powers might be developed. Some of these have already been utilized for mining purposes, and no doubt, with greater transportation facilities and consequent settlement, others will be brought into beneficial use. At present much of this country, especially in-so-far as its water-power possibilities are concerned, is unexplored.

Liard River

The Liard river rises in the Yukon district and flows south into British Columbia just above its confluence with the Dease. It then flows through the province for a distance of 270 miles, and, after passing through the Rocky mountains, turns northward again

to join the Mackenzie river, of which it is one of the chief tributaries Rising in the elevated country to the west of the Rocky mounta .s, the Liard river falls rapidly toward the east, the difference in elevation between the mouth of the Dease river and the Mackenzie being no less than 1,650 feet, of which over 1,000 feet occurs in 200 miles of the river in British Columbia. It is characterized nearly everywhere by impetuous currents, by dangerous rapids and by narrow whirlpool-filled cañons. The descent of the river is greatest and its rapids most numerous while passing through, and for some distance on each side of, the Rocky mountains. The Liard river was used for a number of years as a trading route to the Yukon, but, owing both to the expense incurred in overcoming the great length of difficult navigation and to the number of lives lost, the trade was found unprofitable and most of the posts were abandoned. The Liard has also been used to some extent by prospectors and miners. The discoverers of the Cassiar gold fields, Messrs. McCullough and Thibert, ascended it from Fort Simpson to the mouth of the Dease in 1871-72. The best description of the Lower Liard is given in the *Report of the Geological Survey of Canada*, Vol. IV., 1888-89, pages 33-50D. From the standpoint of navigation, the bad portion of the river starts just above the Little cañon, which is about 24 miles below the mouth of the Dease and 12 miles below the bend, and is a succession of rapids, whirlpools and narrow cañons with occasional stretches of quiet water, until the river narrows at Hellgate. Starting at the Little cañon and proceeding downstream, the following are the chief rapids and cañons—how far they would lend themselves to power development is not known, but probably diversion or other dams could be built at a number of points should mining or other developments create sufficient demand for power.

Little canon, 24 miles below Dease river, half a mile long, narrowest spot 200 feet wide ; banks of dark shales. *Second narrows and whirlpools*, three miles below Little cañon; banks of shales and sandstones, contracting to 100 feet. *Short canon*, about 30 miles below Little cañon, 100 yards long, precipitous limestone cliffs 150 feet apart ; navigable. *Cranberry rapids*, about six miles below Short cañon, one and one-half miles rough water; bed of stream filled with huge angular masses of rock ; rapid in two sections with comparatively quiet water between; rocks of shales, sandstones and conglomerate, similar to Little cañon. *Mountain Portage rapids*, about eight miles below Cranberry rapids, one of the worst rapids ; river falls over band of shales. *Three contractions and rapids* between Mountain Portage rapids and *Whirlpool canon*, four miles below Mountain Portage rapids. *Rapids at Portage Brûlé*, five miles below Whirlpool cañon ; portage two miles long, at lower end, river is narrowly confined between high vertical limestone cliffs. *Devil portage*, about 100 miles below Little cañon. The river at this point makes a great bend to northeast, along which is a succession of rapids and cañons. At the elbow of the bend a large fall is reported ; at the lower end of the bend the river is reduced to scarcely 150 feet wide. Immediately below the contracted part is a large eddy and the river expands at once to over one-half mile in width. The portage across is four miles and climbs over a ridge fully 1,000 feet high. *Grand canon*

of the Liard, 30 or 40 miles long, is really a succession of short cañons, with expanded basins between, filled with eddying currents. It can be run at low water but is very dangerous at flood stages, necessitating several portages. *Rapids of the Drowned*, forming part of Grand cañon. *Canon below Hell-gate*, one mile long, 150 yards wide; river flows easily between vertical banks 300 feet high. This is the last cañon on the river.

The most important tributaries of the Liard river are: Dease river, a navigable stream and a well-known route of travel from the headwaters of the Stikine to the interior; the Kachika, which is the most northerly of the British Columbia rivers occupying the Intermontane valley, and draining, besides, a large area of country, much of which is undeveloped; and the Fort Nelson river, a sluggish stream, about which practically nothing has been published. At Fort Nelson, 100 miles above its mouth, some farming is done, and potatoes and other vegetables are grown without difficulty. The country has considerable timber. There is no information available respecting any water-powers on the main stream. Its tributary, the Sikanni river, has a series of rapids and falls about 40 miles above its mouth; higher up, the valley resembles a deep cañon with sides rising precipitously 1,200 to 1,400 feet and terminating in sandstone cliffs.

Photo. Courtesy Mr. W. F. Robertson

INGENIKA RIVER FALLS, TWO MILES BELOW McCONNELL CREEK

Tributary to Finlay river.

FINLAY RIVER FALLS, FOUR MILES BELOW OUTLET OF THUTADE LAKE

Tributaries to the Mackenzie River—District No. V

Name of Stream and Situation of Power Site	Area of water-shed in square miles*	Selected head in feet*	Estimated horse-power*	Remarks
Liard river ‡	98,000x			
629 Rapids, falls and cañons	34,000§	....	....	The Liard river runs for many miles in cañon with numerous rapids and small falls. Several portages are necessary ; one, 'Devil portage,' at a sharp bend, is 4m. long.
Dease river	6,000x	....	....	Is na ble from Dease lake to Liard river. Descends 4-5 .. per mile with several small rapids
Peace river :				
630 Peace River cañon:	28,500	....	....	Cañon about 18½m. long; total fall about 225 ft.‖
Pine river :				
631 Cañon 4m. above lower forks	Unknown[1]	....	....	Cañon 3m. long ; banks are steep slopes or cliffs of sandstone and shale, rising about 100 ft. above river.
632 Rapids near summit	Unknown	....	....	River said to fall 200 ft. in 5½m.
Nation river (trib. to Parsnip) :				
633 Cañon 15m. above mouth	2,250	....	....	Cañon reported 15m. above mouth ; above cañon, rive is navigable to Nation lakes.[2]
McLeod river :				
634 Falls 1½m. below War (Long) lake	150	120	....	Series of falls, totalling 120 ft. over ledge of diorite rock. Storage in Carp and War (Long) lakes.
Finlay river :				
635 Deserter cañon	17,000x 67,00	....	....	Only considerable obstacle to navigation in 175m. above mouth. Cañon is about 1m. long, through conglomerate ; walls, 160 ft. wide at head, vary in height up to 130 ft. at lower end. Navigable with difficulty at low water by canoe and at high stages by stern-wheelers.[3]
636 Long cañon (about 15m. above Kwadacha river)	2,900	....	....	Cañon 5m. long through schist ; numerous rapids, grade increases towards upper end and river is unnavigable. Above cañon, for 5 miles is a swift, shallow stream averaging 150 yards in width.[3]
637 Cascade cañon	2,700	....	....	Cañon with shallow rocky rapids ; at one point, a 25 ft. fall in short distance in cascades ; several other bad rapids. Cañon at head 100 ft. wide. Total length of gorge 5½m., maximum depth 700 ft.[3]
638 Reef cañon (below Fishing lakes)	2,000	....	....	Cañon 2½m. long ; vertical cliffs 60 to 80 ft. high ; minimum width 130 ft., series of diagonal reefs extend nearly across river.[3]
639 Cañon and falls below Thutade lake	500	....	....	Below lake, river is in cañon for 4m. ; at lower end, fall of 50 to 60 ft. with swift water above and below ; numerous rapids further down stream.[4]
Omineca river :				
640 Black cañon near mouth[5]	5,000	....	....	Cañon ½m. long, 100 to 200 ft. wide ; walls nearly vertical, maximum height over 150 ft. Fall from head of swift portion to mouth is about 425 ft. in about 35m.
Mesilinka river :				
641 Cañon 1m. from mouth	1,600x	....	....	Reported to have several rapids, but only one cañon 1m. from confluence with Omineca
Tutizica river (trib. Mesilinka) :				
642 Falls ½m. below Tutizica lake	Unknown	40	....	Direct fall of 15 ft., 10 ft. in 2,000 ft. rapids above, 15 ft. in 1m. rapids to small lake below. Rocky banks 30 ft. high above head of cañon. River 70 ft. wide at cañon. Storage in Tutizica lake.
Ingenika river (trib. Finlay) :				
643 Cañon 75m. above mouth	....	....	....	Cañon 300 ft. long ; at lower end fall of 15 ft. in chute, through gap 25 ft. wide below cañon ; grade of river is high for some miles below.[3]

*See, Description of Power Tables

‡A good description of the Liard river will be found in *Report of the Geological Survey of Canada*, Vol. IV, Part D, pp. 33-50. The river is navigable from near its mouth for about 300 miles to Hellgate, the entrance to the bad part of the river. Above this are numerous cañons and rapids. The most noteworthy, in the order in which they occur, are : Rapids of the Drowned ; Grand cañon, really a series of short cañons ; Devil portage, a 4m. portage over a ridge 1,000 ft. high, the river flowing in a narrow cañon round the bend; Portage Brule : Whirlpool cañon; Mountain Portage rapids; Cranberry Portage rapids; Little cañon.

§Drainage area above confluence of Coal river, including Kachika river.

‖For description see *Report of the Geological Survey of Canada*, 1875-76, p. 46, also *Wild North Land*, Capt. Butler, p. 249, also *Voyages from Montreal through the Continent of North America*, by Alexander Mackenzie. London, 1801, pp. 167-180 and 392 ; also, *Canada on the Pacific*, by Charles Horetsky. Montreal, 1874, pp. 61 and 239.

[1]Probably about 1,400 sq. miles.

[2]See *Annual Report of Minister of Lands*, British Columbia, for 1914, p. D72.

[3]See *Annual Report of Minister of Lands*, British Columbia, for 1914, p. D84 *et seq.*

[4]See *Annual Report of Minister of Mines*, British Columbia, for 1908, p. 74. Another report gives height of fall as 180 ft.

[5]See "Exploration of Finlay and Omineca Rivers," *Report of the Geological Survey of Canada*, Vol. VII. 1894, Sec. C, p. 7, etc.; also *Wild North Land*, Captain Butler, chapter XXIII, p. 279.

xApproximate drainage area above mouth.

CHAPTER XV

Stream Flow Data

ALTHOUGH, in connection with early mining activities, the province of British Columbia was concerned with the apportionment of the waters of some of the provincial streams, no systematic study of stream flow was prosecuted by government agencies prior to 1911.

The Commission of Conservation, having, in 1910, completed its general investigation respecting the water-powers of eastern Canada, decided to commence, in the following year, a special investigation of the water-power resources of British Columbia and of the Prairie Provinces.

In May, 1911, the Department of the Interior inaugurated the Railway Belt Hydrographic Survey, with headquarters for field work at Kamloops, B.C.

In August, 1911, the Commission of Conservation commenced its field investigation in British Columbia. The Premier and the Minister of Lands expressed themselves as desirous of furthering the work, and gave assurance that every possible assistance would be given. Subsequently, the Province appropriated funds to assist in the field work.

In connection with irrigation, especially in the 'dry belt', many problems and disputes connected with the use and apportionment of the waters of various streams had arisen. It became necessary, therefore, for the officers of the newly constituted Railway Belt Hydrographic Survey to devote their efforts first to the clearing up of this complex situation. They, therefore, for a time, confined their attention to these irrigation problems.

In inaugurating the Railway Belt Survey, the hydrographic methods in use by the Water Resources Branch of the United States Geological Survey were adopted, and one of their expert hydrographers, Mr. C. R. Adams, was engaged for a period of three months to direct the initiation of the work.

Mr. P. A. Carson, formerly Chief Engineer of the Railway Belt Survey, and his staff of engineers deserve great credit for their good prosecution of the work, as well as for the zeal displayed in coping with the many difficulties inherent to territory such as they had to canvass. Mr. R. G. Swan is at present Chief Engineer of the Survey, with headquarters at Vancouver, and to him and his able staff the Commission of Conservation is indebted for the collection of much of the stream flow data published in this report, and also for special assistance rendered in connection therewith.

Investigation of Water Assets

The work of the Kamloops office was diligently prosecuted during 1912. Meantime the British Columbia Government, largely through the efforts of Hon. W. R. Ross, the former Minister of Lands, had commenced an investigation of the water assets of the province, including their administration, and also of the status of the

thousands of licenses and grants which had been made for the use of water. This latter, in itself, was a very heavy undertaking. In connection with its investigations, the Provincial Government, in 1912, also commenced gathering stream flow data. As there was then no co-operation between the Dominion and Provincial officials, some overlapping of effort resulted. In 1913, as an outcome of the transfer of the administration of the waters of the Railway Belt to the province, the stream-flow measurement work of the Railway Belt Hydrographic Survey and that of the Provincial Water Rights Branch were merged, being undertaken by the former organization, under the new title of the British Columbia Hydrographic Survey. Its headquarters were moved to Vancouver, and subsequently branches were established throughout the province. This merging of activities placed systematic and continuous stream gauging on a firm basis and, to a great extent, relieved the engineers of the Provincial Branch from hydrographic work on the main streams, leaving them free to devote their energies to other investigation and administrative work. Recently, the title of the British Columbia Hydrographic Survey was changed to The British Columbia Hydrometric Survey. An historical survey, covering the steps through which the stream flow investigations of the province reached their present status, is presented in the Dominion Water Power Branch *Water Resources Papers*, and also in the *Annual Reports of the Provincial Water Rights Branch.**

The Dominion Water Power Branch, under the superintendence of Mr. J. B. Challies, now conducts, through the British Columbia Hydrometric Survey, the stream-flow investigations in British Columbia, and furnishes copies of its records to the Provincial Government.

Inasmuch as the Commission of Conservation had first commenced the general collection of water-power data in British Columbia, and as the newly-established office at Kamloops had its hands more than full with gathering the needed data respecting irrigation conditions, it was arranged, through the courtesy of the late Mr. R. E. Young and Mr. J. B. Challies, that the Commission would be furnished with such hydrographic data as would be serviceable in connection with water-power studies ; also, with any information relating to water-power sites gathered in the course of the Survey's work. These data have been supplied, and are included in this report. The various courtesies extended in connection with the supplying of this valuable material is highly appreciated by the Commission.

The Hydrometric Survey hopes, later, to include the streams in the more northerly parts of the province, but up to the present, with the exception of certain special studies, they have had to confine their attention to the more southerly part, and more particularly to the 'dry belt,' where the demands respecting irrigation have been so urgent.

The Provincial Water Rights Branch has, itself, also undertaken certain stream flow investigation work. The results of its operations are published in the *Annual Reports of the Minister of Lands, British Columbia*, and in special

*Consult *Water Resources Paper No. 1*, pp. 17 to 37; also ***Annual Report of the Water Rights Branch*** of the Department of Lands, British Columbia, for 1913, p. 5.

publications issued by the branch itself. For list of publications, consult the Bibliography.

In addition to the hydrological data already referred to, a number of valuable records have been obtained by private and other effort ; where available, summaries of these data are presented in this report. These records are as follows :

Gauge heights of the Fraser river, recorded by officers of the Department of Public Works, Canada, at Chilliwack, Mission and Sumas. The record at Chilliwack commences in 1906 and, except at low stages when the water drops below the point where the gauge can be read, is continuous. Unfortunately, there is a deposit of silt around the foot of the gauge, which becomes dry below certain stages. There appears to be a certain relationship manifested between the gauge heights at Chilliwack and those recorded at Hope in the year 1912-1915. If relationship can be established it would be possible to make an approximate estimate of the flow of the Fraser river for the period covered by the Chilliwack records.

Hydrographic studies have been made by various private companies, such as by the British Columbia Electric Railway Co., or subsidiary companies, at lakes Buntzen and Coquitlam, and at Jordan river, V.I.; by the Western Canada Power Company, on Stave river; by the West Kootenay Power and Light Co., at Bonnington falls, on Kootenay river—for gauge heights see *Water Resources Paper No. 14*—(a summary of revised data is given in this report); and by the Powell River Co., which possesses a record of the height of Powell lake since the year 1912, and of the waste water flowing over the dam. There are also hydrological studies made by certain irrigation companies.

Hydrological research has also been prosecuted by engineers and power companies in connection with various projects for municipal water supply, or proposed power developments, some of which have already been carried out. There are, for example, the Couteau Power Company's records of runoff, temperature and precipitation on Shuswap river at Couteau falls. These data have been made available through the courtesy of the company's consulting engineer, Mr. A. R. Mackenzie, and are published in the tables of stream flow data (No. 99). See also Plate J. Messrs. DuCane, Dutcher & Co., consulting engineers, secured data in connection with the development on the Barrière river for the city of Kamloops ; and Messrs. Anderson & Warden, consulting engineers, Vancouver, have taken records at Jones lake for the British Columbia Electric Railway Co. The Campbell River Power Co. has records from several gauges on Campbell river, V.I. These gauges have since been rated by the B. C. Hydrometric Survey, and revised data will be found in the tables of stream flow. The Quesnel Hydraulic Gold Mining Co. has made certain studies of runoff incident to the construction of its placer mining plant in the Cariboo district ; Messrs. Ritchie, Agnew & Co., consulting engineers, have made some valuable runoff studies in connection with suggested power developments on the Falls and Khatada rivers, in the vicinity of Prince Rupert. There are also certain records of lake levels taken by the Canadian Pacific Railway

Lake and River Service. Some of these, made available through the courtesy of Superintendent Captain Gore, are published in this report.

Description of Stream Flow Data

Within the space allotted to stream flow data is included a concise summary of all the more important reliable records available. From the various data it was necessary to make a selection, and hence those most useful for water-power considerations are presented, while those of the smaller 'irrigation' streams, together with those which, for cause, were considered unreliable, have been omitted. The data which follow include records from about 130 stations in British Columbia, and from 10 in the adjacent states of Washington, Idaho and Montana.

When not otherwise indicated, the stream flow records for the British Columbia stations have been summarized from data supplied by the British Columbia Hydrometric Survey of the Dominion Water Power Branch. The data for the stations in the United States have been supplied by the Water Resources Branch of the United States Geological Survey.

Arrangement of Tables—The tables of stream flow data are arranged alphabetically, and also numbered to correspond with a reference number given in 'List of streams in British Columbia for which stream flow data are available.' This list also indicates the district in which the stream is situated. This permits ready reference to the data for any particular district. The summarized data for each station consist of a description of gauging station, discharge measurements and monthly summaries.* The drainage area in square miles appears at the top of each record.

Description of Gauging Station—These descriptions are based on those supplied by the British Columbia Hydrometric Survey, but have been condensed and adapted to meet the essential requirements of the data in the form here presented. An effort has been made to have the descriptions, as supplied for individual years, so combined as to be applicable to the record as a whole.

The accuracy of the results is sometimes indicated by the use of the letters 'A', 'B', 'C', and 'D.' These letters have the same significance as when used by the B. C. Hydrometric Survey in their *Water Resources Papers*, and by the United States Geological Survey in their *Water Supply Papers*, namely 'A' indicates that the mean monthly flow in probably accurate within 5 per cent ; 'B', within 10 per cent ; 'C', within 15 per cent ; and 'D', within 25 per cent. It should be clearly understood that all such references to accuracy refer only to the mean monthly discharges, not to the maximum or minimum, nor to that for any one day.

Note

In the description of gauging station, under the sub-heading 'Accuracy,' there frequently appears a note stating that the monthly summaries, as printed below for certain years, embody revisions based on later measurements.

* For additional data, such as, widths of the various metered sections, daily gauge heights, names of hydrographers, etc., refer to the *Water Resources Papers*, for which, as just stated, there is here given an index to stations.

Estimates of daily discharge are based on the daily gauge heights and are derived from a rating curve based on the available discharge measurements. Obviously, the greater the number of satisfactory measurements, the better defined the rating curve will be ; but, since it is not always possible to obtain in one season sufficient discharge measurements to define satisfactorily the rating curve, subsequent revisions may be entailed. Occasionally, later measurements reveal the fact that, owing to backwater, ice formation, poor metering section or other causes, it is impossible to obtain a satisfactory rating curve at the selected station. As data and deductions of the B. C. Hydrometric Survey are published annually, it not infrequently happens that estimates based on earlier data have to be revised in the light of additional discharge measurements. Through the courtesy of the B. C. Hydrometric Survey, we have been enabled to include most of such revisions up to the end of 1916. See also remarks under 'Drainage Area' and 'Discharge Measurements' below.

Drainage Area—The drainage area at the head of the description of each station has been used in computing the 'Discharge in second-feet per square mile', and the resultant 'Run-off depth in inches on drainage area', and is the area estimated to lie above the gauging station. These areas have been checked from the most recent maps. Where these check measurements did not materially differ from the estimate of drainage areas made by the B. C. Hydrometric Survey, or by other authorities supplying data, or where the maps and other information available allowed considerable latitude in determining the 'height of land' dividing watersheds, the estimates as supplied have been published. Where, however, it seemed advisable, revisions have been made in drainage areas, and such have been indicated by a note to that effect. Such revisions have necessitated the recomputation of the 'discharge in second-feet per square mile' and 'run-off depth in inches on drainage area'; also of certain totals and means.

Discharge Measurements—The discharge measurements made at the gauging station are here presented. Inasmuch as these constitute the basic data for the rating curve and resultant rating table, an appraisement, if so desired, may be made respecting the probable accuracy of the rating curve and, inferentially, to some extent, of the accuracy of the monthly summaries derived therefrom. An inspection of the discharge measurements reveals their number and distribution ; while the maximum and minimum discharges given in the summaries which follow show the extent to which the rating curve has been projected above or below the points for which actual discharge measurements define its position.

Monthly Summaries—The column headed 'Max.' contains the discharge corresponding to the maximum gauge height recorded during the month ; similarly the column headed 'Min.' contains the discharge corresponding to the minimum gauge height recorded during the month. The column headed 'Mean' gives the mean of the daily discharges for the month. The column headed 'Discharge per square mile' is computed by dividing the mean monthly discharge by the estimated drainage area in square miles. The column headed 'Run-off depth in inches on drainage area' is computed by multiplying the run-off per square mile by a factor depending upon the number of days in

the month. (See 'Table of Equivalents', Appendix I.) The figures given in the last two columns are based on the watershed area. (See remarks under 'Drainage Area'.) *

Index to Published Stream Flow Data

It has been deemed desirable to furnish an 'Index' to publications where detailed data respecting gauge heights and daily discharges may be found. In referring to these publications it must be remembered, however, that, since the earlier reports were issued, later data have become available and have enabled some revisions to be made in the summaries here published. (See Note, page 309.)

Those desiring to make detailed study of any particular stream should apply for the latest data to the British Columbia Hydrometric Survey (Dominion Water Power Branch), at Vancouver, B.C., and to the Provincial Water Rights Branch, at Victoria, B.C.

The publications indexed are the *Water Resources Papers*,† published by the Dominion Water Power Branch, Department of the Interior, Ottawa. The volumes containing data relating to the streams of British Columbia are as follows :‡

*Water Resources Paper No. 1***—Report of the 'Railway Belt Hydrographic Survey for 1911-12,' by P. A. Carson, Ottawa, 1914.

Water Resources Paper No. 8—Report of the 'British Columbia Hydrographic Survey for 1913,' by R. G. Swan, Ottawa, 1915.

Water Resources Paper No. 14—'Report of the British Columbia Hydrographic Survey for 1914,' by R. G. Swan, Ottawa, 1915.

Water Resources Paper No. 18—'Report of the British Columbia Hydrometric Survey for 1915,' R. G. Swan, Ottawa, 1917.

Water Resources Paper No. 21—'Report of the British Columbia Hydrometric Survey for 1916,' R. G. Swan, Ottawa, 1918.

The following explanation will make the Index clear :

No.—The numbers in the first column refer, respectively, to the summaries of stream flow records published in this report.

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* For records of complete years and for periods of months which are reasonably comparable, certain totals and averages are here presented. In certain other instances, it was not deemed expedient to record these deductions.

† The references to *Water Resources Papers* do not include Miscellaneous Discharge Measurements. These will be found grouped together as follows : *Water Resources Paper No. 1*, pp. 491 to 494 ; *No. 8*, p. 291 ; *No. 14*, pp. 204, 363 and 530 ; *No. 18*, pp. 176, 307, 421 and 438 ; also *No. 21*, pp. 132, 282, 351, and 356. Some of these so-called miscellaneous measurements have actually been made at regular discharge stations and used in connection with the preparation of rating curves. Sometimes, however, gauge heights and *derived* data of discharge, etc., are not published until a year or so later; hence *Water Resources Papers* subsequently issued should be consulted.

‡ Some stream flow data were published in the *Annual Reports of the Minister of Lands*, British Columbia, for 1912 and 1913. The 1913 report includes the data published in the 1912 report. Most of these data will be found in greater detail in the *Water Resources Papers Nos. 1 and 8*. For other important stations, a revised summary for 1912 and 1913 will be found in this Report.

***Water Resources Paper No. 1* contains, on pages 495 to 537, a useful Hydrographic Gazetteer of lakes, rivers, creeks and other sources of water supply in, and adjacent to the Railway Belt of British Columbia.

District—The letters indicate to which main watershed or district the streams belong, thus : C—Columbia river and tributaries (except Kootenay river) ; K—Kootenay river and tributaries ; F—Fraser river and tributaries (except Thompson river) ; T—Thompson river and tributaries ; V.I.—streams on Vancouver island ; P.C—streams on Mainland Pacific coast (except Fraser river). This column, used in connection with the two following, will assist in finding on a map the situation of each stream and gauging station.

Stream—The streams are tabulated in alphabetical order.

Location of Gauging Station—On the smaller tributary streams it will be noticed that, where there is only one gauging station, as a rule it is situated near the mouth.

Drainage Area—The drainage areas are those above the respective gauging stations. See remarks relating to drainage areas under 'Description of Stream Flow Data'.

Records Available—In this column are given, for the period ending December 1916,* the years, and first and last months, for which reliable records are available. Sometimes, records have only been taken during the irrigation season, or during the open period. See under column 'Remarks'.

*The last year for which records had been completed at the time this portion of the report went to press.

LIST OF STREAMS IN BRITISH COLUMBIA FOR WHICH STREAM FLOW DATA ARE AVAILABLE WITH INDEX TO WATER RESOURCES PAPERS

(This list does not include some of the smaller streams whose flow has been studied in connection with irrigation requirements.)

No.	District	Stream	Location of gauging station	Drainage area	Records available Limiting dates (see remarks)	Water Resources Paper No. 1	8	14	18	21	Remarks
				sq. miles		pg.	pg.	pg.	pg.	pg.	
1	T	Adams river	Below lake	1,160†	July 1911–Dec. 1916	77	163	270	226	201	
2	C	Akolkolex river	Wigwam, near mouth.	105	May 1913–Dec. 1916	...	295	431	351	311	
3	F	Alouette (S. Lillooet) river.	8m. from mouth	100	Oct. 1911–Dec. 1915	322	135	108	103	...	
		do.	At lake outlet	100	Jan. to Dec., 1916	...	...	...	...	61	
4	F	do. North branch	5m. from mouth	20	Oct. 1911–Dec. 1913	317	110	..	..	..	
....	F	Anderson river	Near mouth	200	April 9 to Sept. 30, '12	83	...				
....	C	Ashnola river, trib. Similkameen.	Near Ashnola	480	June 1914–Dec. 1916	...	...	275	...	203	
....	T	Barnes creek, near Ashcroft.	Above Barnes lake.	38	April 1912–Oct. 1916	86	166	327	274	244	Irrig. stream.
5	T	Barrière river	Below power plant.	350†	Mar 1915–Dec. 1916	...	...	...	179	139	
6	C	Beaver river	4m. from mouth	400	May 1913–Dec. 1914	...	300	434	...	...	Open seasons.
....	C	Beaver creek	3m. from mouth	83	June 1915–Nov. 1916	...	...	...	275	246	Small stream.
....	P.C.	Belknap creek	See Mesliloet river	tributaries.							
7	V.I.	Big Qualicum river	Near mouth	62	Mar. 1913–Dec. 1916	...	...	117	142	97	
8	K	Big Sand creek	8m. from mouth	40	May 1914–Oct. 1916	...	...	523	416	332	Irrig. seasons
9	C	Blaeberry river	Near Moberly	325	April 1912–Nov. 1915	88	303	437	353	..	Open seasons.
....	T	Bolean creek, trib. Salmon.	Near Falkland	80	May 1911–Sept. 1916	92	169	207	179	143	
10	T	Bonaparte river	5m. from mouth	2,000	June 1911–Dec. 1916	100	172	330	277	250	
....	T	Botanie creek, near Lytton.	5m. below lake	20†	Sept. 1911–Sept. 1912	106	...	...	...	..	Irrig. stream.
11	F	Boulder creek, near Jones lake.	At mouth	....	April 1913–Dec. 1916	...	58	61	65	31	
12	C	Boundary creek	Greenwood	125	May 1913–Dec. 1916	...	...	278	228	207	
....	P.C.	Brandt creek	See Mesliloet river	tributaries.							
....	P.C.	Brandywine river, trib. Squamish.	Near mouth	....	May 1915–Sept. 1916	...	...	.	112	69	
....	T	Brash creek, trib. Shuswap.	Above intake	10	Oct. 1915–Dec. 1916	...	...	...	230	209	Small creek.
13	F	Bridge river	Above cañon	1,900	June 1913–Dec. 1916	...	148	168	114	72	
14	C	Bugaboo river	1m. from mouth	190	June 1912–Dec. 1916	109	305	440	355	314	Open seasons.
15	K	Bull river	Near mouth	625†	May 1914–Dec. 1915	...	...	494	397	...	Open seasons.
16	P.C.	Bulkley river	Hazelton, near mouth.	4,500†	July to Dec., 1915	...	...	...	427	...	
17	P.C.	do.	3m. above confluence of Telkwa.	2,500†	July to Dec., 1915	...	...	...	427	...	
18	P.C.	Buntzen lake	At outlet	7	1906–Dec. 1913	...	...	...	...	...	
....	T	Cache creek, trib. Bonaparte.	Above diversions	35	June 1911–Aug. 1912	111	...	...	...	...	Irrig. seasons.
....	T	do.	Below diversion to Eight-mile ck.[1]	35	May 1915–Oct., 1916	...	...	...	279	252	Irrig. seasons.
....	T	Cahilty creek, trib. Louis.	1m. from mouth	20	Aug. 1911–Oct. 1912	115	...	...	...	...	Open seasons.
....	T	Campbell creek	Barnhart Vale, Todds Corners.	200	May 1911–Sept. 1915	120	177	210	181	...	Irrig. stream.
....	T	do.	Above Campbell Estate diversions	200	May 1911–Sept. 1912	124	...	...	...	...	
19	V.I.	Campbell river	Outlet, Lower Campbell lake.	600†	May 1910–Dec. 1916	...	...	120	144	99	
....	T	Canoe creek, trib. Shuswap lake	Near Salmon Arm.	30	June 1911–Sept. 1912	126	...	...	...	...	
....	T	Cañon creek	Above Heffley lake.	7	June to Aug., 1914	...	...	213	...	...	Very small stream.
....	C	Canon creek, 6m. from Golden.	¼m. from mouth	50	June 15 to Dec. 30, 1914.	...	...	142	...	...	
20	P.C.	Capilano creek	Above Vancouver intake, 6m. from mouth.	64	Jan. 1914–Dec. 1916	...	150	69	69	35	
....	C	Caribou creek, near Burton.	½m. from mouth	225	Aug. to Dec., 1914	...	...	367	...	...	
....	K	Carpenter creek	Near New Denver.	65	April 20 to Dec., 1914	...	...	368	...	...	
		do. South Fork	In flume near Sandon.	12	April 1914–Dec. 1916	...	...	372	315	291	
21	F	Cayuse creek	Near Lillooet	350	April 1914–Dec. 1916	...	...	171	116	78	
....	T	Celista creek, near Shuswap lake	Near mouth	140†	Feb. 1914–Dec. 1916	...	...	281	..	211	
..	T	Chase creek	Near Chase station	100	June 1911–Oct. 1916[2]	134	...	...	231	215	Open seasons
22	P.C.	Cheakamus river	1m. from mouth	250	Mar. 1914–Dec. 1915	...	151	174	118	...	
23	F	Chehalis river	1½m. from mouth.	200	Nov. 1911–June 1915	140	68	72	71		
24	V.I.	Chemainus river	Near mouth	120	May 1914–Dec. 1916	...	...	123	146	101	

† Revised value based on recent measurements.

[1] Diversion also measured during 1915.

[2] No records for 1913 and 1914.

No.	District	Stream	Location of gauging station	Drainage area	Records available Limiting dates (see remarks)	Water Resources Paper No. 1	8	14	18	21	Remarks
				sq miles.		pg	pg	pg	pg	pg.	
....	T	Cherry creek, trib. Kamloops lake.	Cornwall's ranch..	30	June 1911–Oct. 1916	146	179	223	182	145	Irrig. stream.
....	K	Cherry creek, South-east Kootenay.	Near Wasa.......	See Ma	ther creek.						
25	F	Chilliwack river....	5m. above Sumas lake.	450	Nov. 1911–Dec. 1916[1]	149	72	73	73	37	
26	T	Clearwater river....	Near mouth......	4,100†	Mar. 1914–Dec. 1916	...	...	216	184	147	
....	T	Coldwater river....	Merritt[2].........	360	April 1913–Dec. 1916	...	183	336	282	255	
27	C	Columbia river.....	Trail............	34,000	April 1913–Dec. 1916	...	317	446	319	293	
28	C	do.	Castlegar.........	15,000	Dec. 1912–Dec. 1915	.	314	373	317	..	
29	C	do.	Near Revelstoke...	9,000	Mar. 1912–Dec. 1916	181	311	377	360	316	Open seasons.
30	C	do.	Golden..........	2,500	April 1903–Oct. 1915	157	308	443	358	...	Open seasons.
...	C	do.	Spillimacheen.....	1,700	June to Oct., 1912 ..	185	...	...	...	...	Gauge hgts. only.
....	C	do.	Athalmer.........	540	June to Sept., 1912 .	184	...	...	...	...	do.
31	F	Coquihalla river....	Near Hope.......	360	Nov. 1911–Dec. 1916	187	76	78	75	39	
32a	F	Coquitlam river....	Below lake.......	105	Years 1906 to 1913 .	...	79	...	...	...	
32b	F	do.	1m. above mouth..	115	Jan. 1915–Dec. 1916	...	...	...	77	41	
33	V.I.	Cowichan river.....	Near lake outlet...	235	Mar. 1913–Dec. 1916	...	...	126	148	103	
34	T	Crazy creek........	Near Taft........	45	Mar. 1914–Nov. 1916	...	...	284	233	217	Open seasons.
35	T	Criss creek........	Trib. Deadman river.	150	June 1912–Oct. 1916	195	185	333	284	257	Irrig. seasons.
....	T	Davis creek........	See Fortune creek.								
36	T	Deadman river.....	Above Criss creek.	300	April 1913–Oct. 1916	..	188	339	286	259	Irrig seasons.
....	T	do.	3m. from mouth ..	560	July 1911–Sept. 1911	203	...	...	...	...	do.
....	T	do.	Above Walhachin intake.	450	July 1911–Sept. 1912	200	...	...	...	...	do.
....	T	do.	In flume	......	July 1912–Aug. 1913	204	192	...	..	...	do.
...	F	Doré river, near McBride.	½m. above mouth..	190	July to Nov., 1915...	...	..	...	429	...	
....	K	Duncan river, to Kootenay lake	Near Howser, 10m. above mouth.	830	Dec. 1914–Dec. 1916	...	...	...	322	297	
....	C	Dutch creek, near Fairmont Springs.	½m. from mouth...	250	April to Aug., 1914..	...	...	449	...	..	
37	T	Eagle river.....	Malakwa	350†	May 1913–Dec. 1916	..	194	287	235	219	
....	T	do.	Near Sicamous....	460	Aug. 1911–Dec. 1912	206	..	...	...	...	
....	T	Edwards creek, trib. Hefferly.	3m. from mouth...	15	June 1911–Oct. 1916[3]	210	..	...	186	149	Irrig. stream.
38	K	Elk river..........	Near Elko.......	1,450†	April 1914–Dec. 1916	..	...	503	401	335	Open seasons.
39	V.I.	Englishman river...	½m. from mouth ..	111	Feb. 1913–Dec. 1916	..	..	129	150	105	
....	T	Essell creek, trib. Salmon river.	Near Grand Prairie	6	May 1911–Nov. 1916[4]	214	197	226	...	152	Very small stream.
40	P.C.	Falls creek, trib. Ecstall ; Skeena.	Near mouth......	89	Mar. 1912–Feb. 1913	...	...	...	...	...	
41	K	Findlay creek......	15m. from mouth..	320	April 1914–Dec. 1915	...	...	454	368	...	Open seasons.
....	.....	Flume creek, Indian river.	At mouth........	....	May 1915–Dec. 1916	...	...	...	79	43	Small stream.
....	C	Forsters (No. 2) cr..	1½m. from mouth..	120	May 1912–Oct. 1915	382	343	478	385	...	Open seasons.
....	F	Fountain creek, 10m. from Lillooet.	1½m. from mouth..	20	June 1914–Oct. 1915	...	...	177	122	...	Small, Irrig.
....	T	Fortune creek, near Armstrong.	1m. below city intake.	20	Aug. 1911–Dec. 1912	217	...	...	...	...	
....	K	Fourmile creek.....	See Silverton creek.								
42	F	Fraser river.......	Chilliwack.......	88,300†	Feb. 1906–Dec. 1915	...	...	...	...	...	Gauge heights only.
43	F	do.	Hope...........	84,500†	Mar. 1912–Dec. 1916	225	81	81	82	45	
44a	F	do.	Lytton..........	61,100†	Feb. 1912–Dec. 1914	228	199	342	...	...	Backwater at high stages
44b	F	do.	Lillooet.........	60,600†	May to Dec., 1915...	...	...	...	124	...	
....	K	Fry creek.........	½m. above mouth..	180	Dec. 1914–Dec. 1915	...	...	...	324	...	
....	F	Gilley creek, to Pitt river.	Above power intake.	8[5]	Nov. 1911–Dec. 1912	232	...	...	...	...	
....	K	Glacier creek.......	Near Howser.....	170	June to Nov., 1915..	...	...	...	326	...	
45	K	Goat river.........	Erickson, 5m. from mouth.	430†	May 1914–Nov. 1915	...	...	386	328	...	
....	F	Gold creek, to Coquitlam river	½m. from mouth...	....	July 1910–Nov. 1913	236	90	...	...	...	
46	K	Gold creek.........	7m. north of Newgate.	350†	May 1914–Oct. 1916	...	...	506	403	339	Irrig. stream.
47	C	Granby (Kettle R., N. fork) river.	Grand Forks......	950†	June 1914–Dec. 1915	...	...	292	239	...	
....	C	Granite creek, trib. Tulameen.	Near Coalmont....	70†	June 1914–Sept. 1915	...	...	290	237	...	Open seasons.
48	F	Green river........	Nairn Falls.......	180	Nov. 1913–Dec. 1916	...	152	179	126	82	
....	F	do.	Green Lake......	24	Nov. 1913–Dec. 1914	...	153	183	...	...	
....	T	Greenstone creek, trib. Nicola river.	½m. from mouth...	20	Sept. 1911–Sept. 1916[6]	238	203	...	...	158	Irrig. stream.

† Revised value based on recent measurements.

[1]Records for 1916, as published in *Water Resources Paper No. 21*, are stated to be incorrect.

[2] In June, 1916, new station at 3m. above Merritt.

[3] No data published for 1913 and 1914. [4] No records for 1915.

[5] Estimate possibly too high, area may not exceed 5 square miles. [6] No record for 1914.

No.	District	Stream	Location of gauging station	Drainage area	Records available Limiting dates (see remarks)	Water Resources Paper No 1	8	14	18	21	Remarks
				sq. miles			pg.	pg	pg.	pg.	
....	T	Guichon creek.....	Near mouth......	475	June 1911–Sept. 1912	246					
....	T	do.	Above Mamit lake.	315	June 1911–Oct. 1916	250	205	229	188	161	Irrig. stream.
....	V.I.	Haslam creek, trib. Nanaimo.	2m. above mouth.	38†	May 1914–July 1915	...	.	131	152	...	
....	T	Hat creek.........	Several stations...	......	1911 to 1916........	256	207	344	288	261	Irrig. stream.
....	C	Hedley (Twenty-mile) creek.	Above diversions..	120	April to Sept., 1915	..	...	...	272	...	
....	T	Hefferly creek......	Several stations...	....	1911 to 1916........	268	215	232	190	163	Irrig. stream.
....	P.C.	Hixon creek........	See Mesliloet river	tributaries.							
....	C	Horsethief creek....	1m. from mouth..	250	May 1912–July 1914	278	320	457	...	...	Open seasons.
....	C	Hospital creek, near Golden.	At dam above flume.	18	Oct. 1914–Dec. 1916	...	...	458	370	318	
49	C	Illecillewaet river...	Near Revelstoke...	480	Oct. 1911–Dec. 1916	281	322	462	373	320	Open seasons.
....	C	do.	Glacier	....	May 1913–Dec. 1914	...	325	460	...	...	Open seasons.
50	C	Incomappleux river.	Near Beaton; Arrow lake.	460	May 1914–Dec. 1915	...	360	466	375	...	Open seasons.
....	P.C.	Indian river.......	See Mesliloet river.								
....	T	Ingram creek, trib. Salmon river.	Near Grand Prairie	25	May 1911–Oct. 1916	288	222	238	194	167	Irrig. stream.
....	C	Inonoaklin creek, to Lower Arrow lake.	2m. from mouth..	150	June 1915–Dec. 1916	...	...	...	330	299	
....	T	Jamieson creek, 18m. north of Kamloops.	Two stations......	....	1911 to 1916........	295	226	241	196	169	Irrig. stream.
51	F	Jones creek........	At lake outlet.....	25	April 1910–Dec. 1916	305	98	88	86	49	
52	V.I.	Jordan river.......	½m. above mouth..	60	Jan. 1908–Dec. 1911	...	...	...	...	...	
53	K	Kaslo creek, to Kootenay lake.	Kaslo, near mouth	170	June 1914–Dec. 1916	...	...	389	332	301	
54	C	Kettle river........	Carson...........	2,390†	Sept. 1913–Dec. 1916	...	...	301	247	221	
55	C	do.	Near Nicholson's bridge.	1,620†	Mar. 1914–Nov. 1916	...	...	298	243	225	
....	C	do. North fork.	See Granby river.								
....	C	do. West fork...	See Westkettle riv.								
56	P.C.	Khatada river......	Trib. Skeena.....	60	Dec. 1911–Dec. 1912	...	...	...	...	...	
57	C	Kicking Horse river.	Golden, near mouth	700	April 1912–Dec. 1916	307	329	468	378	323	Open seasons.
58	C	do.	Field...........	130	June 1912–Dec. 1916	312	332	472	380	325	Open seasons.
59	C	do.	No. 2 Tunnel.....	50	July 1912–Dec. 1916	315	336	474	383	327	
60	V.I.	Koksilah river.....	2m. south [illegible] can.	24	May 1914–Dec. 1916	...	...	134	154	107	
61	C	Kuskanax creek....	1m. from Naku[illegible]	[illegible]	[illegible]ar. 1914–Dec. 1915	...	..	392	334	...	
62	K	Kootenay river.....	At Glade.........	19,1[illegible]	May 1913–Dec. 1916	...	339	417	338	303	
....	K	do.	Bonnington Pool..	17,80[illegible]	June to Dec., 1914...	...	...	411		...	
63	K	do.	Upper Bonnington Falls.	17,800	Oct. 1907–Dec. 1915	...	...	395	336	...	
64	K	do.	Nelson..........	17,700	Jan. 1913–Dec. 1915	...	...	412	340	...	
65	K	do.	Wardner.........	5,200	Jan. 1914–Dec. 1916	...	...	508	405	341	
....	F	Laluwissin creek, above Lytton.	Above irrigation ditches.	20	June 1914–Dec. 1916	...	...	185	128	85	Irrig. stream.
66	F	Lillooet river, trib. Harrison lake.	Agerton, 6m. above Lillooet lake.	800	Nov. 1913–Dec. 1916	...	154	187	130	87	
....	K	Linklater creek, near Newgate.	Near Smiths ranch.	42	May 1914–Sept. 1915	...	...	512	407	...	Small irrigation stream
....	T	Little Clearwater river.	5m. above mouth..	84	June 1914–Oct. 1916	...	...	220	198	170	
67	V.I.	Little Qualicum river.	At Cameron lake outlet.	60†	Feb. 1913–Dec. 1916	...	...	137	156	109	
....	K	Little Sand creek, trib. Big Sand ck.	Near Jaffray......	33	April 1914–Oct. 1916	...	...	524	418	343	Irrig. stream.
68	T	Louis creek........	12m. from mouth.	100	July 1911–Nov. 1916	328	229	244	200	172	Open seasons.
69	P.C.	Lynn creek........	Below north Vancouver intake.	14	June 1914–Dec. 1916	...	156	91	88	51	
70	K	Mark creek........	Near Marysville, at mouth.	54†	May 1914–Dec. 1916	...	...	513	409	345	Open seasons.
71	K	Mather (Cherry) creek, south-east Kootenay.	1m. above mouth, near Wasa.	80	May 1913–Oct. 1916	...	...	497	399	334	Irrig. seasons.
....	T	Manson creek, trib. Shuswap lake.	1m. from mouth...	24	April to Sept., 1915..	...	..	...	247	...	Small creek.
72	P.C.	Mesliloet river.....	Below cañon, 8m. from mouth.	65	Oct. 1912–Dec. 1916	337	105	94	90	53	
		Mesliloet tributaries									
72a	P.C.	Belknap creek....	Belknap lake......	....	Oct. 1912–Dec. 1916	338	53	55	61	27	
72b	P.C.	do.	Below Ann lake....	....	June 1914–Dec. 1916	...	147	58	63	29	
72c	P.C.	Brandt creek.....	At mouth.........	....	Oct. 1912–Sept. 1914	338	60	64	...	...	
72d	P.C.	do.	Above Young creek.	....	June 1913–Dec. 1916	...	65	66	67	33	
72e	P.C.	Hixon creek......	½m. from mouth...	....	Oct. 1912–July 1914	338	93	84	...	...	
72f	P.C.	do.	Above Belknap creek.	....	April 1914–Dec. 1916	...	154	86	84	47	
72g	P.C.	Norton creek.....	At lake outlet.....	....	Oct. 1912–Dec. 1916	338	113	99	94	57	
72h	P.C.	Young creek......	Near mouth.......	....	Oct. 1912–Dec. 1916	338	143	115	109	67	
....	T	Monte creek, trib. S. Thompson at Ducks.	Several stations...	....	1911 to 1916........	342	233	247	202	174	Irrig. stream

† Revised value based on recent measurements.

No.	District	Stream	Location of gauging station	Drainage area	Records available Limiting dates (see remarks)	Water Resources Paper No 1	8	14	18	21	Remarks
				sq. miles		pg	pg.	pg.	pg.	pg.	
73	K	Moyie river........	International boundary.	590	July 1914–Dec. 1916	...	...	...	411	347	
....	K	Mud creek, near Elko.	Near mouth......	7	May to Sept., 1914..	...	...	516	...	...	Irrig. stream.
....	T	Murray creek, near Spence Bridge.	Above diversions..	36	Sept. 1911–Dec. 1912	354	...	...	...	...	Irrig. stream.
74	T	Murtle river, trib. Clearwater.	15m. below Murtle lake.	400†	Sept. 1914–Sept. 1916	...	...	256	206	181	
75	F	Nahatlatch river...	Lower station, near mouth.	400	Mar. 1912–Dec. 1916	358	239	350	290	263	
76	F	do. ...	Upper station, below lakes.	300	Mar. 1912–Dec. 1916	358	243	347	...	265	
77	V.I.	Nanaimo river.....	6m. from mouth...	250	Feb. 1913–Dec. 1916	...	...	140	158	111	
....	C	Nakusp creek......	2m. from Nakusp..	40	Mar. to Dec., 1914...	...	...	419	...	...	
78	F	Nechako river......	Vanderhoof.......	9,500	July to Nov., 1915...	...	...	...	434	...	
79	F	do.	Fort Fraser.......	6,150	June to Dec., 1915...	...	...	...	432	...	
80	T	Nicola river........	Near mouth......	2,650	Aug. 1911–Dec. 1916	367	249	355	292	269	Open seasons.
81	T	do.	Merritt..........	1,500	June 1911–Sept. 1915	373	246	352	295	...	
82	T	do.	Nicola..........	1,300	April 1913–Dec. 1916	...	...	...	297	271	No record 1914.
....	T	do.	6m. above Nicola lake.	540	May 1915–Sept. 1916	...	...	...	300	273	
....	F	Nicolum river, trib. Coquihalla.	4m. from mouth...	30	July 1914–Dec. 1916	...	...	97	92	55	Irregular readings.
....	T	Niskonlith creek, trib. S. Thompson	Near mouth.......	50	Aug. 1911–Sept. 1915	378	253	306	248	...	Irrig. seasons.
....	F	North Lillooet river	See Alouette river.								
83	T	North Thompson	Black Pines	7,500†	April 1912–Dec. 1913	...	282	...	...	...	Open seasons.
84	T	do.	Above Barrière river.	7,000	June 1915–Dec. 1916	...	...	...	209	183	
....	C	North Vermilion creek.	Near Edgewater...	20	April 1915–Sept. 1915	...	...	488	392	...	Irrig. stream.
....	P.C.	Norton creek.......	See Mesliloet river	tributa	ries.						
....	C	No. 2 creek.......	See Forster creek.								
85	C	Okanagan river.....	Fairview.........	3,000	April to Dec., 1914...	...	...	308	...	...	
....	C	do.	Okanagan Falls...	2,750	Mar. 1915–Dec. 1916	...	...	...	250	229	
86	C	Ottertail river......	Near mouth, 5½m. W. of Field.	90	June 1912–Oct. 1913	387	346	...	...	...	Open seasons.
87	V.I.	Oyster river.......	Near mouth......	70	June 1914–Dec. 1916	...	...	143	160	113	
....	T	Paul creek.	Several stations...	....	1911 to 1916.......	389	255	258	211	185	Chiefly irrig.
....	F	Pavilion creek	Above irrigation ditches.	82	June 1915–Oct., 1916	...	...	...	132	93	
88	C	Pend-d'Oreille[1]...	Near Waneta...	25,800†	May 1913–Sept. 1915	...	349	422	343	...	
89	K	Phillips creek......	Near Roosville....	23	May 1914–Sept. 1915	...	...	518	413	...	Irrig. stream.
90	P.C.	Powell river	Below lake.......	600	[2]	...	...	...	...	...	
91	V.I.	Puntledge river.....	1m. from mouth...	275†	May 1914–Dec. 1916	...	...	146	162	115	
92	V.I.	do.	At diversion dam..	250†	June 1913–Dec. 1916	...	...	149	164	119	
....	T	Raft river.........	½m. from mouth...	300	June 1914–Nov. 1916	...	...	260	213	187	Open seasons.
....	F	Rainbow creek, trib. Pitt lake.	Near mouth......	20	Nov. 1911–Nov. 1913	404	118	...	...	...	
....	F	Raven creek.......	See Rushton creek.								
....	K	Rock creek, near Elko.	Above mouth Mud creek.	15	May 1914–Sept. 1915	...	...	521	415	...	Used for irrigation.
....	T	Ross creek, to Shuswap lake.	2m. from mouth...	56	April to Dec., 1915..	...	...	...	253	...	
....	F	Rushton (Raven) creek to Pitt lake.	Below fall, ¼m. above mouth.	10	Nov. 1912–Nov. 1913	409	122	...	...	...	
....	F	Rutherford (Six-mile) creek, trib. Green river.	1m. from mouth...	30	June 1914–April 1915	...	...	197	136	...	
93	K	St. Mary river.....	Near Wycliffe.....	825†	June 1913–Sept. 1916	...	...	526	419	349	Open seasons
....	T	Salmon river, to Shuswap lake.	Several stations....	....	1911 and 1912......	409	...	...	...	...	Used for irrigation.
....	....	do.	Falkland.........	350	May 1911–Oct. 1916[3]	...	...	...	215	189	
....	K	Sand creek (Big)...	See Big Sand creek.								
....	K	Sand creek (Little)..	See Little Sand ck.								
....	K	Sawmill creek......	See Wee Sandy ck.								
....	T	Scotch creek to Shuswap lake.	3m. from mouth...	245	April to Dec. 1915...	...	...	...	255	...	
....	T	Scottie creek, trib. Bonaparte river.	Near mouth, above diversions.	73	June 1911–Oct. 1916[4]	423	264	...	...	275	Irrig. stream.
94	F	Seton creek........	Below lake, 3m. from Lillooet.	460	April 1914–Dec. 1916	...	...	192	134	95	
95	P.C.	Seymour creek.....	Above Vancouver waterworks intake.	69†	Nov. 1913–Dec. 1916	...	157	102	96	59	
96	T	Seymour river......	Shuswap lake.....	250	Aug. 1914–Dec. 1916	...	...	...	257	231	
97	V.I.	Shawnigan creek...	Below lake	22	May 1914–Dec. 1916	...	...	152	166	121	
98	T	Shuswap river......	Near Enderby.....	1,900†	Aug. 1911–Dec. 1916	426	259	314	260	233	

† Revised value based on recent measurements.

[1] See also records for Clark Fork in next chapter.

[2] Records of lake levels and waste water over dam since 1912, have been kept by Powell River Co. No record of total run-off is available. [3] No records 1913 and 1914. [4] No records 1914 and 1915.

No.	District	Stream	Location of gauging station	Drainage area	Records available Limiting dates (see remarks)	Water Resources Paper No. 1	8	14	18	21	Remarks
				sq. miles		pg	pg	pg	pg	pg	
99	T	Shuswap river.....	Couteau falls......	760	Jan. 1912–Dec. 1914	...	262				
....	F	Silver Hope creek, near Hope.	½m. from mouth...	80	Nov. 1911–Dec. 1913	430	127	...	...	...	
....	F	Silver Pitt creek...	See Widgeon creek.								
100	K	Silverton (Fourmile) creek.	Below Hewitt mill	41	May 1914–Dec. 1915	...	...	380	345	...	
101	K	Silverton creek.....	Above Hewitt intake.	30	May 1914–Dec. 1915	...	...	383	347	...	
102	C	Similkameen river..	Below Ashnola creek.	2,900†	April 1914–Dec. 1916	...	...	311	262	235	
....	C	Sinclair creek, near Windermere lake.	1m. from mouth...	30	July to Dec., 1914...	...	...	481	.	.	
....	T	Siwash creek, to Heffley lake.	Cippoletti weir ...	7	June 1914–Oct. 1916	...	...	263	217	191	Very small stream.
....	F	Sixmile creek......	See Rutherford ck.								
103	C	Skagit river........	Above International boundary.	356	March to Dec., 1915	...	...	...	100	...	
104	P.C.	Skeena river.......	Old Hazelton.....	9,200	July to Dec., 1915.	...	...	...	436	...	
105	K	Slocan river........	1m. from mouth...	1,300†	Dec. 1912–Dec. 1915	...	352	427	349		
105a	K	do.	Slocan city.......	710	April to Dec., 1916..	...	...	...	...	307	
....	F	Slollicum creek, to Harrison lake.	Near mouth......	....	Discharge measurements only.	...	159	108	...	...	
....	F	Soo river, trib. Green river.	Near mouth......	75	Mar. 1914–April 1915[1]	...	...	200	138	...	
106	C	South Similkameen river.	Princeton.........	750†	May 1914–Nov. 1916	...	...	316	264	237	Open seasons.
....	F	South Lillooet river	See Alouette river.								
107	T	South Thompson river	Chase...........	7,000	April 1911–Dec. 1916	466	285	324	267	239	
....	C	South Vermilion creek, near Edgewater.	½m. above mouth..	10	April 1914–Sept. 1915	...	...	490	394	...	Irrig. stream.
108	C	Spillimacheen river, trib. upper Columbia river.	1m. from mouth...	580	June 1912–Dec. 1916	43'	3	482	388	329	Open seasons.
109	T	Spius creek........	2m. from mouth .	300†	Aug. 1911–Sept. 1915	437	267	358	302	...	
110	V.I.	Sproat river........	Below Sproat lake.	128	Mar. 1913–Dec. 1916	...	...	155	168	123	Open seasons.
111	V.I.	Stamp river........	Stamp falls.......	336	Mar. 1913–Dec. 1916	...	...	162	172	127	
112	V.I.	do.	Outlet Great Central lake.	177	Feb. 1913–Dec. 1916	...	...	159	170	125	
113	F	Stave river........	Stave falls........	450	1901 and 1905 to 1913	...	138				
....	F	Stein creek, near Lytton.	½m. from mouth...	130	Sept. 1911–Aug. 1913	441	271	...	...	...	Used for irrigation.
114	C	Sumallow river.....	1m. from mouth .	70	July 1914–Nov. 1916	...	...	111	105	63	
115	C	do.	8m. from mouth...	17	July 1914–Nov. 1916	...	...	114	107	65	
....	F	Sweltzer creek, trib. Chilliwack.	½m. from mouth...	30	Nov. 1911–Nov. 1912	448	...	...	...	...	
116	F	Texas creek, 14m. from Lillooet.	Near mouth......	80†	April 1914–Sept. 1915	...	...	201	140	...	Irrig. seasons.
117	T	Thompson river....	Spence bridge.....	21,000	Oct. 1911–Dec. 1916	460	273	361	304	278	
118	T	do.	Kamloops........	14,500†	April 1911–Dec. 1914	452	279	264	306	281	Records not reliable.
....	T	Threemile (Durand) creek, to Kamloops lake.	Near Savona......	55	June 1915–Oct. 1916	470	...	...	219	194	Irrig. stream.
119	C	Toby creek........	Near Athalmer, 1m. from mouth.	250†	June 1912–Nov. 1915	470	356	486	390	...	Open seasons.
120	T	Tranquille river....	Near mouth......	230	July 1911–July 1916	473	288	267	220	197	Irrig. seasons.
121	V.I.	Tsolum river.......	2m. from Sandwick	150	May 1914–Dec. 1916	...	...	165	174	129	
122	C	Tulameen river.....	Coalmont........	650	May 1914–Dec. 1916	...	...	320	270	242	Open seasons.
....	C	Twentymile creek..	See Hedley creek.								
....	C	Vermilion creek (North).	See North Vermilion creek.								
....	C	Vermilion creek (South).	See South Vermilion creek.								
....	C	Washout creek.....	Near Galena......	....	April to Sept., 1915..	...	...	...	395	...	Small creek.
....	K	Wee Sandy (Sawmill) creek, to Slocan lake.	At bridge at mouth.	25†	April to Dec., 1914..	...	...	425	...	...	
123	C	West Kettle river...	Westbridge, near mouth.	690	Feb. 1914–Dec. 1916	...	...	295	241	227	
....	T	Whitewood creek, to N. Thompson.	2m. from mouth...	25	Sept. 1914–Oct. 1916	...	...	...	222	199	Small stream.
124	F	Widgeon (Silver Pitt) creek.	2m. from mouth..	30†	Aug. 1912–Dec. 1915	434	131	105	98	...	
....	C	Windermere creek, 7m. from Windermere.	5m. from mouth...	15	April to Sept., 1914 .	...	...	492	...	...	Irrig. stream .
	C	Yoho river.........	At mouth........	60†	1912 and 1913[2].....	487	358	...	...	..	
...	P.C.	Young creek.......	See Mesliloet river tributaries.								

† Revised value based on recent measurements.
[1] Regular gauge readings started Dec. 5, 1914.
[2] No regular gauging station; discharges are deduced from discharges of Kicking Horse river near No. 2 Tunnel and near Field.

Tables of Stream Flow Data for Selected Gauging Stations in British Columbia

1—ADAMS RIVER—below Adams lake

Drainage area, 1,160 square miles *

DESCRIPTION OF GAUGING STATION

Location—Sec. 6, tp. 23, rge. 12, W. 6th mer.

Records available—July and Dec., 1911; Jan. 1, 1912 to Dec. 31, 1916, except Aug. and Sept., 1914.

Drainage area—1,215 sq. miles above mouth ; 1,160 above auging station.*

Gauge—Up to Oct. 17, 1914, Standard vertical staff gauge, 75 yards below dam. Oct. 17, 1914, a Gurley Automatic Water Stage Recorder No. 630 was put into operation, at a point 50 feet below the old staff gauge. A series of readings on both gauges at the same instant gives a definite relationship between old and new gauge readings as follows :—Between gauge heights 0·0 and 2·0 on staff gauge, add 0·6 to give corresponding reading of automatic gauge ; above gauge height 2·0 add 0·7.

Channel—Above dam where meterings are made, 300 to 500 feet wide. Velocities are uniform.

Discharge measurements—Are made above the dam except in very low water when they are made by wading below dam.

Winter flow—Partial ice conditions exist during winter months, but river is seldom frozen over at the gauge sufficiently to have material effect on the accuracy of returns.

Accuracy—Discharge is artificially controlled by Adams River Lumber Co.'s dam. Maximum discharge obtains with all six gates open and the lake at its highest level. It is not necessarily the true maximum discharge of the river. The minimum discharge obtains with all six gates of the dam closed and the fishway only open. It is not necessarily the true minimum. Prior to installation of automatic gauge (Oct. 17, 1914) there was a possibility of error due to the fact that sudden changes in flow, caused by the opening and closing of the Lumber Co.'s dam, may have escaped the observer's notice. Accuracy, on the whole, is fairly good. Some slight revision may be necessary, however, more particularly at high stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
July 7	2,780	2·1	4·4 *	5,900[1]
Nov. 8	1,770	0·3	0·57*	484[1]
" 9	1,700	0·4	0.9 *	602[1]
" 9	1,720	1·2	2·6 *	1,960[1]
" 10	1,700	1·9	3·4 *	3,160[1]
" 11	1,670	0·7	1·7 *	1,180[1]
Dec. 12	96	1·4	−0·3 *	130[2]
1913				
Aug. 19	2,078	2·4	5·40	5,009
" 19	2,081	1·7	4·35	3,300
Aug. 19	2,087	1·5	4·40	3,280
" 19	2,096	1·0	3·60	2,220
1914				
July 3	2,355	2·4	5·40	5,650
1915				
Feb. 25	871	0·3	0·74	272
July 3	2,026	2·5	5·25	5,140
1916				
July 15	2,218	3·1	6·37	6,793
Oct. 25	230	1·9	1·26	436[3]
" 27	1,720	2·1	4·13	3,630

* Staff gauge. [1] Made from boat above dam. [2] Made by wading below dam. [3] Different section.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Jan.	......	......	......	.....	.....
Feb.	......	......	......	.....	.....
Mar	......	......	......	.....	.....
April	......	......	......	.....	.....
May	......	......	......	.....	.....
June	......	......	......	.....	.....
July[1]	6,500	3,070	4,988	4·30	4·95
Aug.	......	......	......	.....	.....
Sept.	......	......	......	.....	.....
Oct.	......	......	......	.....	.....
Nov.	......	......	......	.....	.....
Dec.	135	130	134	0·11	0·13
Period	......	......	......	.....	.....
1912					
Jan.	2,870	127	774	0·67	0·77
Feb.	1,580	127	578	0·50	0·54
Mar.	1,380	110	839	0·72	0·83
April	2,070	85	801	0·69	0·77
May	10,500	85	5,627	4·85	5·58
June	7,800	195	5,029	4·34	4·84
July	9,700	1,210	5,446	4·69	5·39
Aug.	10,500	265	5,718	4·92	5·66
Sept.	6,200	1,810	3,288	2·84	3·16
Oct.	1,810	195	995	0·86	0·99
Nov.	755	165	358	0·31	0·35
Dec.	2,510	165	1,283	1·11	1·28
Year	10,500	85	2,561	2.21	30·16

[1] Gauge was washed out early in August and was not replaced till November.
[2] Summary is for a ten-month period, omitting August and September, for which time it was not possible to procure a gauge reader.

* Revised value based on recent measurements.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1913						**1914**					
Jan.	175	160	160	0·14	0·16	Jan.	1,704	999	1,307	1·13	1·30
Feb.	160	160	160	0·14	0·14	Feb.	1,368	1,207	1,287	1·11	1·15
Mar.	2,290	160	658	0·57	0·66	Mar.	1,368	105	690	0·59	0·68
April	2,409	160	1,521	1·31	1·45	April	3,810	786	2,736	2·36	2·64
May	8,300	2,290	3,484	3·01	3·46	May	6,030	3,175	4,403	3·80	4·37
June	13,800	4,400	9,710	8·37	9·35	June	6,330	5,139	5,900	5·08	5·67
July	5,900	1,050	5,039	4·34	5·00	July	6,330	2,116	4,197	3·62	4·17
Aug.	10,300	1,050	3,406	2·94	3·38	Aug.	......	......	......	.....	.....
Sept.	4,400	910	3,309	2·85	3·17	Sept.	......	......	......	.....	.....
Oct.	1,270	885	1,009	0·87	1·00	Oct.	3,810	570	2,182	1·88	2·16
Nov.	2,870	1,350	1,932	1·66	1·85	Nov.	3,834	1,215	2,077	1·79	1·98
Dec.	1,970	250	824	0·71	0·82	Dec.	1,408	976	1,213	1·04	1·20
Year	13,800	160	2,601	2·24	30·44	Period [1]	6,330	105	2,599	2·24	25·32
1915						**1916**					
Jan.	930	260	441	0·38	0·44	Jan.	1,130	820	1,000	0·86	0·99
Feb.	290	275	279	0·24	0·25	Feb.	1,290	920	1,120	0·97	1·05
Mar.	370	275	310	0·27	0·31	Mar.	1,670	1,030	1,260	1·09	1·26
April	2,960	370	1,531	1·32	0·46	April	3,150	600	1,760	1·62	1·81
May	6,930	3,030	5,055	4·36	5·01	May	6,010	2,920	4,910	4·23	4·88
June	5,380	2,480	4,100	3·54	3·94	June	8,660	5,310	6,680	5·76	6·43
July	7,270	3,260	5,006	4·31	4·96	July	8,150	4,980	7,560	6·52	7·52
Aug.	3,180	2,610	2,723	2·35	2·70	Aug.	6,150	960	4,190	3·61	4·16
Sept.	3,340	750	1,774	1·53	1·70	Sept.	3,490	430	1,800	1·55	1·73
Oct.	1,230	750	807	0·70	0·81	Oct.	3,450	250	560	0·48	0·55
Nov.	1,536	860	1,051	0·91	1·01	Nov.	450	300	440	0·38	0·42
Dec.	1,690	675	1,027	0·89	1·03	Dec.	450	450	450	0·39	0·45
Year	7,270	260	2,010	1·74	23·62	Year	8,660	250	2,640	2·28	31·25

2—AKOLKOLEX RIVER—near mouth

Drainage area, 105 square miles

DESCRIPTION OF GAUGING STATION

Location—At waggon-road bridge just above falls, about two miles from Wigwam station.

Records available—From May 1, 1913, to Dec. 31, 1916.

Climatic conditions—Heavy winter snowfall.

Gauge—Chain gauge referenced to three bench marks. From May to October, gauge is read three times a week, November to April, once a week.

Channel—Straight for 100 yards above and below section. Water is swift; flows through rock box cañon for 150 yards above and below section. Control is rock and appears permanent.

Discharge measurements—Are made from upstream side of bridge. It is difficult to obtain accurate soundings in high water.

Winter flow—Occasionally affected by ice. Stream at section seldom freezes except for a day or two. Anchor ice seldom forms for more than one or two days at a time.

Accuracy—Apparently accurate meterings have been made, but monthly summaries will be subject to error due to infrequency of gauge readings. Mean monthly discharge probably within 10 to 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913					July 24	239	3·88	4·30	929
May 7	157	2·56	2·35	402	Aug. 10	190	2·82	3·10	537
" 30	363	7·43	7·50	2,700	Sept. 6	171	2·18	2·40	373
June 9	455	9·18	10·00	3,990	Oct. 10	150	2·18	2·20	329
" 27	314	6·40	6·45	2,110	1915				
July 17	268	4·98	4·90	1,340	Mar. 18	116	1·19	1·20	138
" 25	299	5·32	5·75	1,590	May 14	250	4·60	4·80	150
Aug 13	235	4·37	4·28	1,070	Oct. 28	210	3·28	3·56	689
Se 6	186	2·92	3·10	530	Nov. 30	140	1·45	1·60	202
N... 20	106	1·71	1·70	180	1916				
1914					Mar. 18	130	1·44	1·75	[illegible]68
Mar. 18	121	1·48	1·35	179	June 1	248	4·06	4·78	1,010
May 19	275	4·95	5·30	1,360	July 18	342	7·08	7·40	2,420
June 26	312	5·34	6·10	1,670	Aug. 12	240	3·61	4·47	868

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						**1914**					
Jan.	.....	.....	.....	.....	.....	Jan.	226	177	191	1·81	2·07
Feb.	.....	.....	.....	.....	.....	Feb.	177	150	161	1·53	1·59
Mar.	.....	.....	.....	.....	.....	Mar.	210	150	178	1·70	1·96
April	.....	.....	.....	.....	.....	April	770	168	481	4·58	5·11
May [1]	2,810	320	1,493	14·22	16·37	May	1,890	1,000	1,430	13·6	15·70
June	4,100	1,980	2,760	26·30	29·34	June	2,950	1,300	1,970	18·8	21·00
July	2,540	1,120	1,770	16·84	19·42	July	2,780	893	1,790	17·0	19·60
Aug.	1,630	755	1,090	10·38	11·97	Aug.	1,260	350	739	7·04	8·12
Sept.	1,300	440	691	6·58	7·35	Sept.	540	274	415	3·95	4·41
Oct.	536	274	344	3·28	3·78	Oct.	485	310	384	3·66	4·22
Nov.	274	175	224	2·13	2·38	Nov.	540	282	363	3·46	3·86
Dec.	175	100	127	1·21	1·40	Dec.[2]	290	150	181	1·72	1·98
Period	.....	.....	.....	.....	.....	Year	2,950	150	690	6·58	89·62
1915						**1916**					
Jan.	187	75	142	1·35	1·56	Jan.[3]	.....	.....	113	1·09	1·26
Feb.	156	103	121	1·15	1·20	Feb.[3]	.....	.....	115	1·09	1·18
Mar.	244	103	154	1·47	1·70	Mar.	425	115	224	2·13	2·46
April	1,140	281	672	6·40	7·14	April	855	211	387	3·68	4·11
May	1,990	1,040	1,410	13·4	15·40	May	1,450	597	937	8·92	10·30
June	1,860	1,000	1,290	12·3	13·70	June	7,220	975	2,760	26·30	29·30
July	1,760	985	1,370	13·0	14·50	July	3,840	1,210	2,240	21·30	24·60
Aug.	1,310	605	963	9·17	10·60	Aug.	1,520	547	912	[illegible]	10·00
Sept.	693	202	331	3·15	3·51	Sept.	1,150	320	571	5·44	6·07
Oct.	677	202	320	3·05	3·52	Oct.	404	202	258	2·46	2·84
Nov.	422	194	260	2·47	2·76	Nov.	260	139	188	1·79	2·00
Dec.	202	129	180	1·71	1·97	Dec.	139	108	120	1·14	1·31
Year	1,990	75	601	5·72	77·56	Year	7,220	108	736	7·00	95·43

[1] For period May 6 to 31. [2] Estimated Dec. 16 to 31. [3] Mean monthly discharge estimated from gauge heights and climatic conditions.

3—ALOUETTE (SOUTH LILLOOET) RIVER—8 m. from mouth. Drainage area, 100 sq. miles*

DESCRIPTION OF GAUGING STATION

Location—To Dec., 1915, at upper highway bridge, eight miles from mouth, in sec. 28, tp. 12, east of Coast mer. Just south of Yennedon post office and about seven miles below Alouette lake. For 1916 at outlet from Alouette lake, tp. 4, range 4, west 7th mer.

Records available—Oct. 26, 1911, to Dec., 1916.

Co-operation—Records for 1916 supplied by Burrard Power Co.

Gauge—Chain gauge near centre of bridge, read daily. Power Co's. gauge is vertical staff.

Channel—Permanent rocky channel ; at B.C. Hydrometric station, stream is confined by bridge piers and roadway, to one channel, width 80 to 125 feet.

Discharge measurements—Are made from the bridge.

Winter flow—Open water all year.

Accuracy—Varies, 1911 and 1912, B and C ; 1913, A, B and D ; 1914 and 1915, B.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1913				
Oct. 26	113	2·0	1·18	226	May 22	266	4·4	2·45	1,180
Dec. 13	316	4·3	2·80	1,360	July 10	296	3·8	2·40	1,120
					1914				
1912					Aug. 21	80	1·5	0·50	113
July 4	151	2·4	1·50	361	Oct. 22	371	5·5	3·12	2,000
Aug. 17	288	3·5	2·70	1,010	1915				
Sept. 10	234	3·3	2·00	767	April 15	321	4·70	3·05	1,520
Nov. 13	608	8·1	4·60	4,950	July 5	90	2·00	0·80	183

* Also estimated by Burrard Power Co. at 140 square miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1911						**1912**					
Jan.	.....	.....	.....	.....	.....	Jan.	3,560	150	1,412	14·12	16·27
Feb.	.....	.....	.....	.....	.....	Feb.	2,810	430	1,393	13·93	15·03
Mar.	.....	.....	.....	.....	.....	Mar.	380	130	210	2·10	2·42
April	.....	.....	.....	.....	.....	April	970	260	455	4·55	5·06
May	.....	.....	.....	.....	.....	May	1,060	590	802	8·02	9·25
June	.....	.....	.....	.....	.....	June	1,730	430	817	8·17	9·11
July	.....	.....	.....	.....	.....	July	660	260	387	3·87	4·46
Aug.	.....	.....	.....	.....	.....	Aug.	1,260	170	520	5·20	5·99
Sept.	.....	.....	.....	.....	.....	Sept.	1,860	150	533	5·33	5·94
Oct.	.....	.....	.....	.....	.....	Oct.	1,860	200	763	7·63	8·80
Nov.	5,670	150	1,589	15·89	17·75	Nov.	6,190	530	2,111	21·11	23·56
Dec.	3,360	470	1,265	12·65	14·58	Dec.	2,150	470	1,062	10·62	12·23
Period	.....	.....	.....	.....	.....	Year	6,190	130	872	8·72	118·12
1913						**1914**					
Jan.	1,420	220	593	5·93	5·84	Jan.	8,350	240	1,450	14·50	16·70
Feb.	5,290	140	1,180	11·80	12·29	Feb.	1,080	170	532	5·32	5·54
Mar.	2,830	160	693	6·93	7·99	Mar.	2,000	320	1,040	10·40	12·00
April	1,420	320	872	8·72	9·73	April	2,000	270	1,030	10·30	11·50
May	2,170	440	1,238	12·38	14·30	May	1,320	370	594	5·94	6·85
June	1,640	840	1,095	10·95	12·18	June	550	270	367	3·67	4·10
July	1,310	320	757	7·57	8·72	July	270	110	161	1·61	1·86
Aug.	750	140	303	3·03	3·49	Aug.	120	100	108	1·08	1·24
Sept.	2,170	120	526	5·26	5·87	Sept.	2,150	105	656	6·56	7·32
Oct.	4,410	120	1,021	10·21	11·76	Oct.	5,600	230	1,210	12·10	13·95
Nov.	5,920	580	2,038	20·38	22·74	Nov.	4,700	480	2,280	22·80	25·44
Dec.	1,880	320	900	9·00	10·38	Dec.	1,710	135	387	3·87	4·46
Year	5,920	120	[illegible]	9·34	126·29	Year	8,350	100	818	8·18	110·06
1915						**1916**					
Jan.	2,150	160	743	7·43	8·57	Jan.	1,417	111	399	3·99	4·60
Feb.	880	320	583	5·83	6·07	Feb.	6,800	231	1,370	13·70	14·78
Mar.	2,470	420	860	8·60	9·91	Mar.	5,828	397	1,620	16·20	18·68
April	4,950	230	1,400	14·00	15·62	April	1,950	711	1,050	10·50	11·71
May	840	210	492	4·92	5·67	May	1,452	739	1,040	10·40	11·99
June	480	140	225	2·25	2·51	June	1,382	735	922	9·22	10·29
July	150	125	140	1·40	1·61	July	1,452	559	873	8·73	10·06
Aug.	125	100	109	1·09	1·26	Aug.	579	186	311	3·11	3·58
Sept.	115	95	105	1·05	1·17	Sept.	175	82	121	1·21	1·35
Oct.	3,400	100	970	9·70	11·20	Oct.	917	50	116	1·16	1·34
Nov.	2,820	320	884	8·84	9·86	Nov.	2,298	255	979	9·79	10·92
Dec.	4,500	420	1,360	13·60	15·70	Dec.	1,348	231	534	5·34	6·16
Year	4,950	95	656	6·56	89·15	Year	6,800	50	778	7·78	105·46

4—ALOUETTE (NORTH LILLOOET) RIVER, NORTH BRANCH—5 m. from mouth

Drainage area, 20 sq. miles*

DESCRIPTION OF GAUGING STATION

Location—At bridge, five miles from mouth, in sec. 29, tp. 12, east of Coast mer.
Records available—Oct. 27, 1911, to Dec. 11, 1913.
Gauge—Vertical staff gauge at bridge pile, read daily.
Channel—Gravel bottom, water deep and quiet at gauge.
Discharge measurements—Are made from the bridge at high stages or by wading at low water.
Winter flow—Open water all year.
Accuracy—Good.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					Aug. 17	44·7	2·16	3·65	98·2 [3]
Oct. 27	16·3	1·79	4·35	291·0 [1]	Sept. 10	27·0	1·30	2·89	35·1 [2]
Dec. 18	13·0	0·87	2·28	11·3 [2]	Nov. 14	115·0	1·48	3·91	170·0 [1]
1912					1913				
Mar. 16	24·6	0·7	2·60	17·3 [2]	July 11	44·3	2·32	3·48	102·0
July 4	24·7	0·92	2·7	22·8 [2]					

[1] From bridge. [2] By wading. [3] Different section.

* This estim^ʼ of drainage area may be too high. Consult maps.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1911					
Nov.	....	....	....	....	....	Nov.	1,500	8	250	12·5	13·9
Dec.	....	....	....	....	....	Dec.	1,100	35	162	8·1	9·3
1912						1913					
Jan.	550	24	172	8·6	9·9	Jan.	865	29	77·1	3·85	4·44
Feb.	630	29	154	7·7	8·3	Feb.	1,533	20	174·1	8·70	9·38
Mar.	35	17	22	1·1	1·3	Mar.	1,197	20	118·6	5·93	6·84
April	141	29	49	2·5	2·8	April	470	42	138·1	6·91	7·71
May	107	29	60	3·0	3·5	May	590	35	151·2	7·56	8·72
June	365	24	60	3·0	3·3	June	287	50	83·7	4·18	4·66
July	93	17	34	1·7	2·0	July	243	20	61·2	3·06	3·53
Aug.	570	14	62	3·1	3·6	Aug.	188	14	28·4	1·42	1·64
Sept.	400	12	52	2·6	2·9	Sept.	400	8	39·3	1·96	2·19
Oct.	47	17	81	4·0	4·6	Oct.	1,220	9	151·8	7·59	8·75
Nov.	1,300	29	226	11·3	12·6	Nov.	1,380	14	228·3	11·40	12·72
Dec.	1,150	35	136	6·8	7·8	Dec.[1]	400	42	77·9	3·90	4·50
Year	1,300	12	92	4·6	62·6	Year	1,580	8	111·0	5·54	75·10

[1] Partly estimated.

3—BARRIÈRE RIVER—near mouth

Drainage area, about 300 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge near mouth, below City of Kamloops power plant, and forty miles from Kamloops.

Records available—Mar. 22 to Dec. 31, 1915 ; Mar. 27 to Dec. 31, 1916.

Gauge—Chain gauge in 1915, replaced on April 8, 1916, by standard staff gauge at same section.

Channel—Straight for 100 yards above and below measuring section ; bed, stones and gravel ; water swift. Width of stream at measuring section 50 to 90 feet.

Discharge measurements—Well define the rating curve.

Winter flow—At times affected by ice.

Accuracy—Results considered reliable.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1910					1916				
Sept. 24	....	....	....	280	Mar. 27	75	1·72	6·90	130
1911					April 7	97	2·45	7·36	238
July 28	....	....	....	750	May 19	222	5·18	9·05	1,150
1915					June 19	366	7·55	10·70	2,760
Mar. 2	56	1·5	....	83	July 22	205	3·75	8·45	770
" 15	66	1·6	6·7	104	Sept. 1	108	1·80	7·15	195
May 6	254	4·7	9·5	1,200	1917				
Aug. 14	107	2·6	7·5	280	Jan. 12	35	1·33	....	46
Sept. 1	88	2·2	7·0	199					

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1915						1916					
April	1,040	140	570	1·90	2·12	April	610	180	290	0·97	1·08
May	2,340	850	1,750	5·83	6·72	May	1,680	690	1,280	4·27	4·92
June	1,360	910	1,090	3·63	4·05	June	3,050	1,270	2,000	6·66	7·43
July	1,440	560	875	2·92	3·36	July	2,440	370	1,100	3·66	4·22
Aug.	560	200	320	1·07	1·23	Aug.	750	175	285	0·95	1·09
Sept.	150	130	135	0·45	0·50	Sept.	215	130	165	0·55	0·61
Oct.	200	110	140	0·47	0·54	Oct.	350	110	155	0·52	0·60
Nov.	200	110	145	0·48	0·54	Nov.	120	90	100	0·33	0·37
Dec.	110	95	100	0·33	0·38	Dec.	80	50	66	0·22	0·25
Period	2,340	95	569	1·90	19·44	Period	3,050	50	605	2·01	20·57

* Another estimate makes the drainage area 350 square miles.

6—BEAVER RIVER—near Six-mile Creek — Drainage area, 400 square miles*

DESCRIPTION OF GAUGING STATION

Location—Tp. 29, rge. 25, W. 5th mer., 4 miles from mouth, on downstream side of Lumber Co's. bridge, about 150 yards from the railway station at Six-mile Creek.

Records available—May 24 to Nov. 1, 1913; April 1 to Dec. 31, 1914; station discontinued 1915.

Climatic conditions—Winters severe with heavy snowfall.

Gauge—Chain gauge, referenced to three bench marks, read daily at 5 p.m., at which time, during the summer freshet, the river is considered to be at a mean height for the day.

Channel—Straight for 100 yards above and below the section. The river is very swift during high stages, and accurate soundings can only be made at low water. During the freshet in June, July and August water flows through two or three small side channels. The control is not very permanent.

Discharge measurements—Are made from downstream side of bridge.

Winter flow—Ice conditions exist generally from the end of November till the end of March. Frazil ice is to be contended with.

Accuracy—Fair; rating curve is fairly well defined though the section does not appear to be good. The fact that during the summer the river varies greatly on a warm day depreciates the value of the daily gauge reading.

Remarks—Beaver river has its source in the Grand glacier of the Selkirks, at an elevation of about 6,000 feet. It is 40 miles long and discharges into the Columbia near Beavermouth at an elevation of about 2,500 feet The watershed is heavily timbered and very mountainous. The C.P. Ry. main line follows the valley from Beavermouth for 15 miles to Bear Creek near Rogers pass, and the river in its lower reaches winds across a broad valley. There are no inhabitants, except a few C.P. Ry. employees and a lumber camp near the mouth. The scattered areas of agricultural land have not been taken up, and lumbering is the only industry. In 1913, the McCreary Lumber Co., who hold valuable timber limits, commenced operations at Six-mile Creek.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec*	*Feet*	*Sec.-feet*
1913				
May 24	357	8·51	3·00	3,040
June 5	601	8·00	4·30	4,840
" 12	656	8·26	4·65	5,420
July 7	609	8·61	4·55	5,240
" 20	485	9·20	4·20	4,460
Sept. 15	231	6·02	2·05	1,390
Dec. 3	122	2·87	0·45	330 [1]
1914				
June 22	390	6·30	3·21	2,440
" 10	489	5·87	3·35	2,870
Sept. 8	373	5·62	2·70	2,100
Oct. 24	157	4·26	1·0	670

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1913					
April	....	....	....	....	....
May	....	....	....	....	....
June	6,420	2,720	4,640	11·6	12·9
July	5,300	2,460	4,140	10·4	12·0
Aug.	4,940	2,340	3,880	9·71	11·2
Sept.	4,100	1,350	2,070	5·17	5·77
Oct.	1,980	560	1,130	2·83	3·26
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
1914					
April	1,460	....	993	2·48	2·86
May	3,500	1,790	2,520	6·30	7·26
June	6,980	2,700	4,390	11·0	[illegible]
July	7,860	2,840	5,450	13·6	15·7
Aug.	6,710	2,160	3,570	8·92	10·3
Sept.	2,840	1,060	1,750	4·38	4·89
Oct.	[illegible]	615	810	2·02	2·33
Nov.	785	615	712	1·78	1·99
Dec.	920	550	604	1·51	1·74

* If measured from British Columbia Department of Lands Map 1 E. Kootenay, 1915, the area, including Six-mile creek, appears to be about 440 square miles.

7—BIG QUALICUM RIVER—near mouth — Drainage area, 62 square miles

DESCRIPTION OF GAUGING STATION

Location—One thousand feet upstream from Esquimalt and Nanaimo Ry. bridge.

Records available—Mar. 3, 1913, to April 30, 1914, Provincial Water Rights Branch ; May 21, 1914, to Dec. 31, 1916, British Columbia Hydrometric Survey.

Gauge—Eighteen-foot wooden staff, installed in 1913 by Provincial Water Rights Branch, on left bank about 100 feet above E. & N. Ry. bridge; read daily, except from Nov., 1913, to April, 1914, when gauge was read 2 or 3 times a week.

Channel—Straight for 300 feet above and below section; even gravel bed.

Discharge measurements—Are made by cable carrier or by wading.

Winter flow—Open all winter.

Accuracy—Results should be within 10 per cent, except at highest stage.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
Mar. 3	65·9	3·58	2·19	184 [1]
1914				
May 21	105	1·33	2·20	140 [2]
July 9	51·3	1·39	1·80	71·3
Aug. 30	37·5	0·72	1·45	26·9
Dec. 10	92·9	2·87	2·60	267
1915				
April 15	98·2	3·26	2·65	314
Sept. 4	17·4	1·39	1·27	24·3 [3]
Nov. 1	148	5·26	3·55	778
1916				
Oct. 27	27	0·86	1·30	23·2 [4]

[1] Metered at E. & N. Ry. crossing. [2] Station established at new section, cable carrier installed. [3] Not at regular section. [4] Wading measurement.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.[1]	238	112	152	2·45	2·64
April	280	164	216	3·48	3·88
May	240	140	190	3·07	3·54
June	280	185	239	3·86	4·29
July	220	92	158	2·55	2·94
Aug.	92	70	75	1·21	1·39
Sept.	240	70	119	1·92	2·14
Oct.	560	240	362	5·84	6·73
Nov.	1,120	280	425	6·86	7·65
Dec.	740	460	520	8·39	9·67
Period	1,120	70	246	3·97	44·87
1914					
Jan.	2,130	460	1,370	22·10	25·47
Feb.	1,600	460	713	11·51	11·97
Mar.	1,600	740	1,041	16·80	19·37
April	1,120	460	854	13·78	15·38
May[2]	200	120	149	2·40	2·77
June	140	100	114	1·84	2·05
July	100	45	63	1·02	1·17
Aug.	45	35	36	0·58	0·67
Sept.	120	35	59	0·95	1·06
Oct.	2,350	85	731	11·80	13·60
Nov.	1,800	460	890	14·36	16·04
Dec.	810	100	243	3·92	4·51
Year	2,350	35	522	8·42	114·06 [3]
1915					
Jan.	810	140	318	5·13	5·91
Feb.	410	140	257	4·15	4·32
Mar.	460	170	269	4·34	5·00
April	680	120	302	4·87	5·43
May	120	100	107	1·73	1·99
June	100	35	60	0·97	1·08
July	35	25	30	0·48	0·55
Aug.	25	20	21	0·34	0·39
Sept.	20	20	20	0·32	0·36
Oct.	1,300	20	248	4·00	4·61
Nov.	810	170	389	6·27	7·00
Dec.	1,040	320	554	8·93	10·29
Year	1,300	20	215	3·47	46·93
1916					
Jan.	280	100	162	2·62	3·02
Feb.	1,800	120	557	8·98	9·69
Mar.	2,020	360	765	12·30	14·20
April	510	360	435	7·02	7·83
May	410	240	315	5·08	5·86
June	320	200	241	3·89	4·34
July	200	100	143	2·31	2·66
Aug.	100	35	56	0·90	1·04
Sept.	35	25	34	0·55	0·61
Oct.	55	20	22	0·36	0·42
Nov.	360	100	199	3·21	3·58
Dec.	460	140	260	4·19	4·83
Year	2,020	20	266	4·28	58·08

[1] For period Mar. 3 to 31, 1913. [2] For period May 21 to 31 only; estimate for year assumes May 1 to 20 had similar mean discharge, it was probably more. [3] 1914 was a year of exceptionally heavy precipitation over the centre portion of Vancouver Island. See precipitation records for locality.

8—BIG SAND CREEK—near Jaffray — Drainage area, 40 to 50 square miles

DESCRIPTION OF GAUGING STATION

Location—About 8 miles from mouth, at an old private bridge about 300 yards below highway and C.P. Ry. bridges, near Jaffray.

Records available—May to Sept., 1914; April to Sept., 1915; April to Oct., 1916.

Co-operation—This station was maintained co-operatively by the Provincial Water Rights Branch, and the B. C. Hydrometric Survey.

Gauge—5-foot wooden staff gauge, read daily.

Channel—Uniform and smooth, with swift water ; bed, light gravel. A shift in control occurred in June, 1916.

Discharge measurements—Reliable and rating curve good.

Accuracy—The results for 1914 and 1915 should be within 5 per cent; after the freshet in June, 1916, results at higher stages --above discharge of 200 sec. ft.—not so good.

General—Creek flow is used for irrigation.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
July 3	83·4	....	1·79	306 [1]
Aug. 22	45·4	....	0·66	68·5 [1]
Oct. 29	39·9	....	0·54	58·2 [1]
1914				
May 19	93·8	5·44	2·3	511
June 19	81·5	4·53	2·0	369
July 9	51·2	2·64	1·20	135
" 29	28·4	1·65	0·65	47·1
Sept. 9	19·9	1·10	0·35	21·9
1915				
April 24	60·6	3·15	1·40	191

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft per sec.*	*Feet*	*Sec.-feet*
May 13	67·8	4·30	1·65	292
June 1	56·2	3·10	1·35	175
" 16	39·0	2·31	0·97	90·7
Aug. 29	16·2	0·75	0·18	12·2
1916				
June 22	116·2	7·71	2·58	895
July 11	95·4	4·97	1·75	474
" 29	50·2	2·23	0·71	112
Aug. 19	49·4	2·08	0·68	103
Sept. 13	38·4	1·56	0·40	60
Oct. 6	24·7	1·04	0·05	26

[1]About 6,000 ft. above C.P.R. bridge over creek.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
May....	....	....	....	....	....
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
			1915		
April....	432	34	212	5·30	5·91
May....	420	172	252	6·30	7·26
June....	1,190	91	218	5·45	6·08
July....	443	52·8	138	3·45	3·98
Aug....	52·8	11·2	24·6	0·61	0·70
Sept....	13·2	9·2	10	0·25	0·28
Oct....	....	....	....	....	....
Period...	1,190	9·2	142	3·55	24·21

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
			1914		
May...	730	282	506	12·65	14·58
June...	615	177	348	8·70	9·71
July...	233	42	106	2·65	3·06
Aug....	40·2	9·5	22·9	0·58	0·67
Sept....	98·6	8·0	34·1	0·85	0·95
			1916		
April...	332	65·4	141	3·52	3·93
May...	657	137	325	8·12	9·36
June...	1,460	332	765	19·10	21·30
July...	1,100	104	397	9·92	11·44
Aug....	113	44	71	1·77	2·04
Sept..	148	30·4	57·6	1·44	1·61
Oct....	29·2	16·6	21·7	0·54	0·62
Period.	1,460	16·6	253	6·39	50·30

9—BLAEBERRY RIVER—near Moberly

Drainage area, 325 square miles

DESCRIPTION OF GAUGING STATION

Location—SW¼ sec. 29, tp. 28, rge. 22, W. 5th mer., on downstream side of C.P.R. bridge, about one mile from mouth.

Records available—April 15 to Nov. 14, 1912 ; June 1 to Nov. 30, 1913 ; April 1 to Nov. 30, 1914 ; April 1 to Nov. 30, 1915 ; discontinued 1916.

Gauge—Vertical staff gauge, read three times a week during the open season. Chain gauge established July, 1915.

Channel—Straight for about 50 yards above and below the station. The water is swift and controlled by a sand bar about 100 yards downstream. This bar probably shifts. Exceptionally high water on the Columbia may affect the gauge readings.

Discharge measurements—Are made from downstream side of C.P. Ry. bridge. Eight in 1912. Nine in 1913, which formed a rating curve varying considerably from that of 1912. Five measurements were made in 1914 and, due to shift of bar, a new curve was plotted. Five in 1915. Rating curve of 1914 used for 1915.

Winter flow—Ice conditions exist usually from middle of November to end of March. Frazil ice at times.

Accuracy—Due to infrequency of gauge readings, and apparent non-permanency of the control, the results are only fair—probably within about 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911				
Oct. 16	177	1·75	0·90	310
1912				
Feb. 21	[illegible]	0·41	....	53·5 [1]
June 6	[illegible]	2·43	1·40	484
" 7	237	3·15	1·90	746
" 15	398	7·28	3·50	2,900
July 11	293	4·52	2·72	1,330
" 27	279	4·08	2·43	1,140
Oct. 3	215	2·40	1·40	512
1913				
May 24	290	4·59	2·45	1,330
June 15	340	5·90	3·10	2,010
July 5	310	4·89	2·70	1,510
" 5	310	4·94	2·70	1,560
" 23	360	6·36	3·32	2,290
Aug. 2	341	6·33	3·15	2,160
Sept. 5	335	5·60	3·02	1,880
" 16	250	3·64	1·90	910
" 30	154	1·38	0·50	212
1914				
June 12	357	5·15	3·10	1,840
July 27	323	3·96	2·60	1,280
Aug. 5	322	4·53	2·80	1,460
Sept. 10	230	2·50	1·75	573
Oct. 13	188	2·19	1·3	412
1915				
Mar. 3	104	0·55	Ice	57
May 6	238	3·38	2·15	802
July 4	332	6·34	3·28	2,110
" 13	340	4·89	2·82	1,660
Oct. 21	165	1·80	1·10	298

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
April	340	130	200	0·62	0·69
May	1,160	310	770	2·37	2·73
June	4,000	490	1,820	5·61	6·26
July	1,570	1,160	1,350	4·16	4·80
Aug.	3,600	930	1,670	5·14	5·91
Sept.	1,000	450	736	2·26	2·52
Oct.	530	310	391	1·20	1·40
Nov.	....	....	....	....	....
1913					
April	....	....	....	....	....
May	....	....	....	....	....
June	3,460	1,530	2,450	7·54	8·41
July	2,740	1,270	1,880	5·77	6·65
Aug.	2,740	1,030	1,840	5·66	6·52
Sept.	1,440	720	1,058	3·26	3·64
Oct.	900	370	607	1·87	2·16
Nov.	415	170	274	0·84	0·94
1914					
Mar.	600	355	428	1·32	1·47
April	1,310	600	905	2·78	3·20
May	3,120	1,260	2,210	6·80	7·59
June	3,290	1,360	2,340	7·20	8·30
July	2,760	880	1,520	4·68	5·40
Aug.	1,060	425	608	1·87	2·09
Sept.	660	256	422	1·30	1·50
Oct.	324	236	278	0·86	0·96
Nov.	....	....	....	....	....
1915					
Mar.	....	....	....	....	....
April	660	[illegible]	354	1·09	1·22
May	1,720	[illegible]	1,060	3·26	3·76
June	4,160	[illegible]	1,800	5·54	6·18
July	2,600	[illegible]	2,180	6·71	7·74
Aug.	2,440	[illegible]	1,890	5·81	6·70
Sept.	1,260	[illegible]	628	1·93	2·15
Oct.	460	[illegible]	371	1·14	1·31
Nov.	425	200	277	0·85	0·95

10—BONAPARTE RIVER—5 m. from mouth

Drainage area, 2,000 square miles

DESCRIPTION OF GAUGING STATION

Location—Sec. 18, tp. 21, rge. 24, W. 6th mer.; near Collins ranch, about 5 miles from mouth.

Records available—June 10 to Nov. 6, 1911 ; Mar. 25 to Dec. 22, 1912 ; Mar. 30 to Dec. 31, 1913 ; Jan. 1 to Dec. 9, 1914 ; Feb. 20 to Dec. 25, 1915 ; Feb. 1 to Dec. 31, 1916.

Gauge—Standard vertical staff gauge ; read daily.

Channel—Straight at measuring section ; average width 50 feet. Velocity high.

Discharge measurements—Are made by wading, except at high water, when cable carrier is used.

Winter flow—Ice conditions prevail during January and February.

Accuracy—Rating curve is well defined and accuracy of results considered good. New curve 1916, accuracy not so good.

General—Bonaparte river lies in the dry belt and its tributaries are being increasingly used for irrigation. A power development was made in cañon about 4 miles from Ashcroft, but, in 1913, the dam failed, and the power plant has since been out of commission.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911				
June 10	109	3·3	2·25	364
July 14	81	2·2	1·49	177
Sept. 26	40	1·7	0·99	67
" 26	40	1·7	0·99	70
1912				
April 24	78	2·9	1·57	226
May 9	153	4·9	3·10	756
June 16	93	3·2	1·95	297
July 17	....	....	1·65	229
" 30	100	2·8	1·70	289
Aug. 26	79	2·3	1·35	286
Oct. 3	48	1·8	1·08	87
1913				
April 25	153	4·35	2·96	667[1]
May 3	114	3·63	2·30	415[1]
" 19	154	4·30	2·81	664[1]
" 27	160	4·65	2·99	745[1]
1913				
July 31	81	2·87	1·76	233[2]
Oct. 3	51	1·67	1·09	85[2]
1914				
May 22	160	6·28	3·23[3]	1,005
July 9	107	3·35	1·98[4]	359
1915				
Mar. 30	56	1·85	1·15	103
April 24	70	1·94	1·35	136
May 6	60	1·76	1·23	107
Aug. 20	128	2·21	1·97	284
1916				
May 13	137	2·57	2·28	354
June 13	176	5·20	3·55	915
Aug. 22	103	2·50	1·96	258
Oct 17	57	1·72	1·36	99
1917				
Jan. 17	38	1·31	.....	50

[1] Cable measurement. [2] Wading measurement. [3] Actual gauge height, 3·30; gauge sunk 0·07 ft during the previous winter, thus making actual readings 0·07 ft. too high. [4] Actual gauge height 2·05.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
April....	....	....	....	....	....
May.....	....	....	....	....	....
June....	405	207	284	0·14	0·16
July....	207	113	169	0·08	0·09
Aug.....	102	25	61	0·03	0·04
Sept.....	79	18	50·6	0·025	0·03
Oct.....	59	42	49·6	0·025	0·03
Nov.....	....	....	....	....	....
Dec.	....	....	....	....	....
Period...	....	....	....	....	....
1912					
April ..	495	90	177	0·09	0·10
May...	830	535	673	0·33	0·38
June...	535	244	334	0·17	0·19
July...	317	195	247	0·12	0·14
Aug....	207	136	167	0·08	0·09
Sept....	183	90	137	0·07	0·08
Oct....	113	90	105	0·05	0·06
Nov....	106	79	93	0·05	0·06
Dec....	90	79	84	0·04	0·05
Period.	830	79	224	0·11	1·15
1913					
Jan.....	....	....	....	....	....
Feb.....	....	....	....	....	....
Mar. ..	....	....	....	....	....
April ...	885	124	408	0·20	0·22
May....	680	340	553	0·28	0·32
June....	655	340	486	0·24	0·27
July ...	540	230	399	0·20	0·23
Aug.....	245	145	184	0·09	0·10
Sept.....	145	80	104	0·05	0·06
Oct.....	124	72	106	0·05	0·06
Nov.....	115	80	100	0·05	0·06
Dec.....	105	72	86	0·04	0·05
Period...	885	72	270	0·13	1·37
1914					
Jan....	123	56	83	0·04	0·05
Feb....	70	42	52	0·03	0·03
Mar...	205	70	132	0·06	0·07
April...	795	150	450	0·22	0·25
May ..	1,768	651	1,150	0·57	0·66
June...	753	475	590	0·29	0·32
July...	458	205	295	0·15	0·17
Aug. .	205	56	114	0·06	0·07
Sept....	137	42	88	0·04	0·05
Oct....	96	70	78	0·04	0·05
Nov	123	70	91	0·05	0·05
Dec.[1]..	137	96	....	....	....
Year...	1,768	42	270[2]	0·13	1·82[2]
1915					
Feb.....	....	....	....	....	....
Mar ..	175	100	141	0·07	0·08
April....	225	120	174	0·09	0·10
May....	815	140	382	0·19	0·22
June....	745	335	418	0·21	0·23
July....	910	365	598	0·30	0·35
Aug.....	615	225	339	0·17	0·20
Sept. ...	210	125	166	0·08	0·09
Oct.....	140	115	127	0·06	0·07
Nov. ..	185	90	118	0·06	0·07
Dec.....	....	....	....	....	....
Period...	910	90	274	0·14	1·41
1916					
Feb....	105	48	72	0·04	0·05
Mar. ..	180	57	115	0·06	0·07
April...	330	130	215	0·11	0·12
May...	890	370	550	0·27	0·31
June ..	1,060	790	930	0·46	0·51
July...	790	480	640	0·32	0·37
Aug. ..	480	165	310	0·15	0·17
Sept....	165	105	130	0·06	0·07
Oct....	130	86	100	0·05	0·06
Nov....	115	86	95	0·05	0·06
Dec....	96	50	70	0·03	0·04
Period..	1,060	48	293	0·15	1·83

[1] For period Dec. 1 to 9, after which winter conditions obtained [2] Estimated.

11—BOULDER CREEK—near mouth

Drainage area, not known

DESCRIPTION OF GAUGING STATION

Location—Near mouth of creek and near Jones lake in sec. 28, tp. 3, rge. 27, W. 6th mer.

Records available—Jan., 1913, to Dec., 1916.

Co-operation—The records of this stream are kept by Messrs. Anderson and Warden, civil engineers, Vancouver, for the Vancouver Power Co.

Gauge—A fine wire is stretched tightly across the stream and the distance to water surface measured with a graduated rod. These figures are subtracted from 15·00 to give direct readings.

Channel—Bed of stream covered with large rocks, giving an uneven bottom but good control.

Winter flow—Stream freezes over for one or two months each winter.

Accuracy—Below 100 sec. ft. A to B ; above 100 sec. ft. C to D.

Remarks—The flow of this stream is being studied in connection with proposed development. of Jones creek. See page 174.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911 Nov. 3	24	0·5	4·20	12·6	1914 July 21	34	0·7	4·40	22·7
1912 Sept. 8	24	0·5	4·25	13·4	1915 April 23	39·2	1·00	10·3	40·4
1913 July 24	52	1·6	4·90	84·6	1916 July 14	47·5	1·73	5·00	82·5
Sept. 11	34	1·0	4·60	34·6	Nov. 24	26·6	0·59	4·35	15·7

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						**1914**					
Jan.[1]	....	....	....	....	....	...	300	15	52	....	....
Feb.[1]	....	....	....	....	....	eb.	95	13	25	....	....
Mar.[1]	....	....	....	....	....	Mar.	160	22	61	....	....
April	130	12	42	....	....	April	180	25	92	....	....
May	200	22	118	....	....	May	200	65	135	....	....
June	250	113	169	....	....	June	150	50	91	....	....
July	2?0	43	117	....	....	July	95	15	44	....	....
Aug.	0	15	28	....	....	Aug.	25	9	13	....	....
Sept.	200	15	42	....	....	Sept.	105	9	26	....	....
Oct.	340	16	66	....	....	Oct.	85	13	25	....	....
Nov.	200	25	58	....	....	Nov.	160	25	76	....	....
Dec.	50	15	25	....	....	Dec.	37	10	17	....	....
Period	....	....	....	....	....	Year	300	9	55	....	....

Month	Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1915						**1916**					
Jan.	22	13	14	....	....	Jan.[2]	....	....	15	....	....
Feb.	16	11	13	....	....	Feb.[2]	....	....	48	....	....
Mar.	120	13	40	....	....	Mar.	325	26	132	....	....
April	200	37	80	....	....	April	180	37	77	....	....
May	160	28	76	....	....	May	240	58	125	....	....
June	105	37	57	....	....	June	260	110	167	....	....
July	75	14	29	....	....	July	230	74	125	....	....
Aug.	13	9	11	....	....	Aug.	92	20	42	....	....
Sept.	14	9	10	....	....	Sept.	52	11	20	....	....
Oct.	240	10	62	....	....	Oct.	65	8	15	....	....
Nov.	105	16	31	....	....	Nov.	350	17	45	....	....
Dec.	180	13	38	....	....	Dec.[2]	....	....	16	....	....
Year	240	9	38	....	....	Year	350	8	69	....	....

[1] Creek frozen for portions of Jan., Feb. and Mar., 1913, during which periods gauge heights not available.
[2] In 1916 ice conditions affected gauge-height-discharge relation Jan. 1 to Feb. 17, Dec. 6 to 17 and Dec. 24 to 31. Mean discharges during these periods, estimated.

12—BOUNDARY CREEK—at Greenwood

Drainage area, 125 square miles

DESCRIPTION OF GAUGING STATION

Location—At Greenwood ; on upstream side of traffic bridge.

Records available—May 1, 1913, to Dec. 7, 1914; Feb. 21 to Dec. 22, 1915; Feb. 22 to Dec. 31, 1916.

Drainage area—Above station, 125 sq. miles ; above mouth, 190 sq. miles.

Gauge—Vertical staff gauge on upstream side of bridge ; read daily.

Channel—Straight for about 300 feet above and below measuring section. Bed, rocky and permanent.

Discharge measurements—Nine during 1914, 1915 and 1916.

Winter flow—Ice conditions exist during January and February.

Accuracy—Considered good ; results should fall within 10 per cent. Monthly summary, as given below for 1913, is here revised.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					June 9	79·7	3·43	2·50	273
May 20	99·8	3·8	2·9	379	1916				
June 8	84·0	3·2	2·5	269	Mar. 15	21·0	0·76	0·90	16
July 20	41·0	1·28	1·21	53	June 22	91·0	3·19	2·60	291
Aug. 26	15·6	0·77	0·77	12	Aug. 8	37·0	1·44	1·30	54
1915					1917				
Mar. 23	39·1	1·15	1·20	45	Jan. 15	16·7	0·60	....	10

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1913						1914		
Jan.	....	....	....	....	....	Jan.	28	20	21	0·17	0·19
Feb.	....	....	....	....	....	Feb.	20	20	20	0·16	0·17
Mar.	....	....	....	....	....	Mar.	45	20	30	0·24	0·28
April	....	....	....	....	....	April	560	45	335	2·68	2·99
May	720	190	434	3·47	4·00	May	559	325	428	3·42	3·93
June	650	270	432	3·46	3·86	June	491	133	273	2·18	2·43
July	350	64	153	1·22	1·41	July	133	28	66	0·53	0·61
Aug.	60	24	42	0·34	0·39	Aug.	28	3	13	0·10	0·11
Sept.	24	18	21	0·17	0·19	Sept.	28	2	9	0·07	0·08
Oct.	36	19	23	0·18	0·21	Oct.	[illegible]	14	23	0·18	0·21
Nov.	28	20	25	0·20	0·22	Nov.	45	36	42	0·34	0·38
Dec.	23	16	20	0·16	0·18	Dec.[1]	36	32	....	....	....
Period	720	16	144	1·15	10·46	Year	560	2	107[2]	0·86[2]	11·68[2]
			1915						1916		
Feb.	....	....	....	....	....	Feb.	23	14	15	0·12	0·13
Mar.	84	14	33	0·26	0·30	Mar.	33	13	21	0·17	0·20
April	420	90	286	2·28	2·54	April	350	38	145	1·16	1·29
May	600	255	410	3·28	3·78	May	560	245	340	2·72	3·14
June	460	90	217	1·74	1·94	June	435	245	315	2·52	2·81
July	115	80	94	0·75	0·86	July	540	65	230	1·84	2·12
Aug.	80	14	45	0·36	0·41	Aug.	65	17	43	0·34	0·39
Sept.	20	9	14	0·11	0·12	Sept.	33	10	16	0·13	0·14
Oct.	20	14	17	0·14	0·16	Oct.	15	12	13	0·10	0·11
Nov.	20	17	18	0·14	0·16	Nov.	17	15	17	0·14	0·16
Dec.[3]	17	14	....	....	....	Dec.	15	10	13	0·10	0·11
Period	600	9	126	1·01	10·27	Period	560	10	107	0·8[illegible]	10·60

[1] For period Dec. 1 to 7, after which winter conditions obtained. [2] Estimated. [3] For period Dec. 1 to 22, after which ice conditions obtained.

13—BRIDGE RIVER—above cañon

Drainage [illegible] 900 square miles

DESCRIPTION OF GAUGING STATION

Location—Highway bridge, 10 miles from Mission on road to Bridge river from Mission on Seton lake ; 30 miles from mouth.

Records available—June 13, 1913, to Dec. 31, 1916.

Co-operation—Readings taken by British Columbia Hydrometric Survey in co-operation with Bridge River Power Co.

Drainage area—Above mouth 2,500 sq. miles ; above gauging station 1,900 sq. miles.

Gauge—Staff gauge fastened to timber abutment of bridge and read twice daily.

Channel—Wide and deep, sand and mud bottom, an excellent measuring section.

Discharge measurements—Are made from the upstream side of bridge.

Winter flow—The stream is frozen over during colder winter months, and the gauge height-discharge relation affected by ice conditions.

Accuracy—A well defined rating curve and gauge readings twice a day should give accurate results. The estimated low water discharges for the winter months have been substantially increased by the B. C. Hydrometric Survey, based upon a revision in 1916 of their rating curve and upon a consideration of gauge heights and climatic conditions. Compare dis-

charge tables in *Water Resources Paper No. 21*, pp. 72-78, with earlier tables in Paper *No. 18*, p. 114, and *No. 14*, p. 168. The monthly summaries given below embody the latest revisions.

General—See pages 171 and 236 for further particulars of Bridge river.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet	1915	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					Feb. 16	724	0·76	0·95	549[2]
Oct. 7	1,050	1·8	2·38	1,890[1]	May 7	1,090	3·10	3·75	3,410
1914					June 24	1,794	4·73	7·00	8,482
April 17	912	2·05	2·25	1,865	Aug. 9	1,790	4·73	6·80	8,470
" 19	932	2·25	2·43	2,101	1916				
June 9	1,432	3·56	4·75	5,130	May 6	1,260	3·33	4·55	4,200
" 20	2,120	5·54	8·10	11,750	June 24	2,340	6·80	9·75	15,910
Aug. 3	1,826	4·83	6·80	8,820	Sept. 27	1,06[illegible]	2·47	3·15	2,630
Sept. 21	1,044	1·97	2·55	2,060	Dec. 14	....	....	1·05	467[2]

[1] Station established. [2] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	15,800	5,800	10,310	5·43	6·26
Aug.	15,400	5,400	9,635	5·07	5·84
Sept.	7,400	2,600	3,670	1·93	2·15
Oct.	6,900	1,610	2,560	1·35	1·56
Nov.	1,610	880	1,155	0·61	0·68
Dec.	1,100	700	790	0·42	0·48
Period	....	....	....	....	....
1915					
Jan.	....	....	650	0·34	0·39
Feb.	....	....	600	0·32	0·33
Mar.	1,240	600	883	0·46	0·53
April	3,700	1,080	2,250	1·18	1·32
May	7,500	2,300	4,939	2·60	3·00
June	10,800	4,400	8,136	4·28	4·77
July	14,800	7,570	10,720	5·64	6·50
Aug.	[illegible]	9,100	11,340	5·97	6·88
Sept.	9,700	2,550	4,497	2·37	2·64
Oct.	3,400	1,160	1,800	0·95	1·09
Nov.	....	....	767	0·40	0·45
Dec.	....	....	530	0·28	0·32
Year	....	....	3,926	2·07	28·22

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	930	650	772	0·41	0·47
Feb.	700	700	700	0·37	0·38
Mar.	1,160	700	857	0·45	0·52
April	2,180	870	1,650	0·87	0·97
May	9,900	2,400	5,530	2·91	3·36
June	18,800	5,100	9,180	4·83	5·40
July	14,900	6,400	12,200	6·42	7·40
Aug.	9,200	5,800	7,760	4·08	4·70
Sept.	5,700	2,100	3,520	1·85	2·06
Oct.	11,100	2,000	3,790	1·99	2·29
Nov.	3,620	1,590	2,030	1·07	1·19
Dec.	1,590	650	879	0·46	0·53
Year	18,800	650	4,072	2 14	29·27
1916					
Jan.	....	....	520	0·27	0·31
Feb.	1,730	520	858	0·45	0·48
Mar.	1,540	810	1,000	0·53	0·61
April	1,730	1,040	1,320	0·69	0·77
May	6,700	2,180	4,000	2·10	2·42
June	19,800	5,600	[illegible]	6·32	7·05
July	15,400	6,620	11,300	5·95	6·86
Aug.	11,600	5,420	9,300	4·89	5·64
Sept.	9,820	2,350	4,710	2·48	2·77
Oct.	3,300	1,240	1,800	0·95	1·09
Nov.	1,240	490	728	0·38	0·42
Dec.	....	....	466	0·25	0·29
Year	....	....	4,000	2·10	28·71

Note.—Gauge height-discharge relation affected by ice and discharges estimated from gauge heights and climatic conditions, as follows: 1914—Dec. 12 to 31, 650 c.f.s. 1915—Jan., Feb. and Dec. as shown; Mar. 1 to 4, 600 c.f.s.; Mar. 5 to 8, 700 c.f.s.; Nov. 14 to 30, 540 c.f.s. 1916—Jan. and Dec. as shown; Feb. 1 to 10, 620 c.f.s.; Nov. 13 to 30, 450 c.f.s.

14—BUGABOO CREEK—near mouth

Drainage area, 190 square miles*

DESCRIPTION OF GAUGING STATION

Location—On downstream side of highway bridge, one mile from mouth. Three miles southwest of Spillimacheen landing, 40 miles south of Golden.

Records available—June to Oct., 1912; June to Nov., 1913; April 1 to Dec. 15, 1914; Mar. 17 to Dec. 29, 1915; April 1 to Dec. 31, 1916.

Gauge—Vertical staff gauge, fastened to pier of bridge; read daily during the open season.

Channel—Straight for 100 feet above and below the gauge; velocity high during freshet; one channel in low water and two at high stages. Bed, rough and rocky; banks, low and bushy. Channel is not permanent.

* Estimates differ considerably, ranging from 120 to 190 sq. miles. The higher value here adopted appears more consistent with the measured runoff.

Discharge measurements—Meterings are taken from downstream side of bridge. A new rating curve was plotted in 1914, using 1912, 1913 and 1914 measurements. In 1915, the rating curve was further revised below gauge height of 1·50. Five measurements define the 1916 curve.

Winter flow—Winters severe; creek usually frozen over from November to April. Frazil ice.

Accuracy—Above discharge of about 270 sec. ft., accuracy B; below discharge of about 270 sec. ft., accuracy C and D.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912					1914				
June 1	96·3	2·89	1·45	278	June 17	187	10·21	3·00	1,910
" 8	138	6·08	2·40	839	July 31	151	6·40	2·35	970
July 16	128	5·34	2·15	684	Oct. 23	96	1·71	1·10	164
Sept. 29	85·8	1·87	1·02	161	1915				
1913					Feb. 28	73·6	0·69	0·50	50
May 20	103	2·94	1·35	303	May 3	114	3·53	1·75	403
June 23	152	6·88	2·40	1,040	" 21	116	4·09	1·87	477
July 11	150	6·87	2·40	1,030	Oct. 22	89·4	1·56	1·12	140
" 27	158	6·66	2·38	1,050	1916				
" 30	139	5·70	2·05	744	June 13	137	3·94	2·25	540
Sept. 3	118	4·04	1·85	478	" 15	178	6·02	2·95	1,070
" 14	111	3·65	1·69	406	July 5	169	6·93	3·05	1,170
Nov. 26	84·7	1·36	1·00	115	Aug. 23	118	4·67	2·25	551
					Nov. 10	72	1·08	0·80	78

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
1913					
April....	....	....	....	....	....
May....	....	....	....	....	....
June....	2,910	820	1,650	8·70	9·71
July....	,650	570	1,070	5·63	6·49
Aug....	1,390	510	878	4·62	5·33
Sept....	1,790	350	569	2·99	3·34
Oct....	400	160	292	1·54	1·78
Nov....	220	85	145	0·76	0·85
Period...	....	....	....	....	....
1915					
April....	372	62	171	0·90	1·00
May....	803	314	471	2·48	2·86
June....	1,390	423	693	3·65	4·07
July....	1,390	563	1,020	5·37	6·19
Aug....	1,460	746	1,000	5·26	6·06
Sept....	648	161	287	1·51	1·68
Oct....	214	103	148	0·78	0·90
Nov....	....	....	....	....	....
Dec....	....	....	....	....	....
Period...	1,460	62	541	2·85	22·76

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
June...	1,430	230	805	4·23	4·72
July...	1,210	560	743	3·92	4·51
Aug....	810	300	584	3·07	3·54
Sept....	340	155	233	1·23	1·37
Oct.[1]...	245	118	151	0·80	0·92
1914					
April...	230	58	140	0·74	0·82
May...	856	310	525	2·76	3·18
June...	2,510	600	1,217	6·40	7·14
July...	2,585	800	1,486	7·82	9·02
Aug....	1,170	468	700	3·68	4·24
Sept....	560	230	375	1·97	2·20
Oct....	333	140	226	1·19	1·37
Nov....	250	79	156	0·82	0·92
Period..	2,585	58	603	3·18	28·89
1916					
April...	176	52	86	0·45	0·50
May...	415	171	285	1·50	1·73
June...	3,060	362	1,140	6·00	6·69
July...	2,210	704	1,310	7·05	8·13
Aug....	1,020	370	680	3·58	4·13
Sept....	704	126	312	1·64	1·83
Oct....	250	84	115	0·60	0·69
Nov.[2]..	....	....	56	0·29	0·32
Dec.[2]..	....	....	40	0·21	0·24
Period..	3,060	....	450	2·37	24·26

[1] On Oct. 31 river commenced to freeze over and station was abandoned for season.
[2] Ice conditions obtained Nov. 16 to Dec. 31, discharge estimated at 40 sec.-ft.

15—BULL RIVER—near mouth

Drainage area, 625 square miles*

DESCRIPTION OF GAUGING STATION

Location—At mouth, near Bull River settlement, 6 miles from Wardner.

Records available—May to Nov., 1914; April to Dec., 1915.

Gauge—Vertical staff gauge, about 100 yards below Bull River Lumber Co.'s dam, one mile from mouth; read daily.

* Revised value based on recent measurements.

Channel—Straight for 100 yards above and below gauge. Channel at the measuring section shifted considerably during June and possibly the first week in July, 1914.

Discharge measurements—Are made from the railway bridge.

Winter flow—Winters severe ; ice conditions generally exist from November to end of March.

Accuracy—Due to changes in channel accuracy is only fair, and no revision of early data has been made. May, June and July, 1914, accuracy D; after July, 1914, accuracy C and B.

General—Bull river is about 30 miles long. It rises in the Rocky mountains among peaks from 8,000 to 10,000 feet above sea-level, and flows, generally, in a southwesterly direction through cañons and over shifting gravel beds into the Kootenay near Bull River settlement. One mile from the mouth the river is controlled by the Bull River Lumber Co.'s mill-dam. This company owns timber limits on the upper waters and every year drives its logs to its mill.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914				
April 28	502	3·78	2·02	1,870
May 15	677	7·01	4·10	4,880 [1]
June 6	608	6·19	3·50	3,770 [1]
" 15	642	7·04	4·10	1,980 [1]
July 30	388	3·39	1·30	1,310
" 26	442	3·16	1·40	1,400
Oct. 8	425	1·60	0·74	685
" 13	419	1·59	0·70	668
Dec. 17	117	1·19	....	140 [2]
1915				
April 28	504	3·48	2·10	1,740
May 14	552	4·53	2·40	2,500
May 29	548	5·24	2·85	2,870
June 17	528	5·00	2·60	2,640
July 4	535	4·63	2·65	2,480
Aug. 30	405	1·58	1·15	641
Nov. 24	342	1·19	0·49	407 [3]
1916 [4]				
Mar. 2	....	....	Ice	203
April 5	....	....	0·60	587
July 9	....	....	4·71	7,410
July 27	....	....	2·14	2,050
Aug. 17	....	....	1·56	1,160
Sept. 8	....	....	1·61	1,110
Oct. 5	....	....	....	542

[1] Soundings incorrect. [2] Ice conditions. [3] Peculiar conditions owing to dam above gauge.
[4] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 352.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
April....	....	....	....	....	....
May....	5,230	2,600	3,920	6·27	7·22
June....	7,060	2,600	4,190	6·71	7·49
July....	4,090	1,290	2,410	3·86	4·47
Aug.....	1,290	475	800	1·28	1·48
Sept.....	1,6[illegible]	390	688	1·10	1·22
Oct.....	1,510	665	866	1·39	1·60
Nov.....	2,220	570	1,070	1·71	1·90
Dec.....	....	....	....	....	....
Period...	7,060	390	1,990	3·19	25·38

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
April...	3,450	400	1,550	[illegible]·48	2.77
May...	4,120	1,490	2,470	[illegible]·96	4·56
June...	3,860	1,760	2,630	4·22	4 71
July...	3,450	1,360	1,960	3·14	3·61
Aug....	1,360	685	992	1·59	1·84
Sept....	685	500	596	0·95	1·05
Oct....	890	335	514	0·82	0·94
Nov....	620	335	504	0·81	0·90
Dec....	335	335	335	0·54	0·62
Period..	4,120	335	1,280	2·05	21·00

16—BULKLEY RIVER—at Hazelton

Drainage area, about 4,500 square miles*

DESCRIPTION OF GAUGING STATION

Location—At ferry crossing, about ¼ mile above confluence with Skeena river, ¾ of a mile from Old Hazelton.

Records available—Gauge heights from July 13 to Dec. 31, 1915.

Gauge—Chain gauge at low level suspension bridge over Bulkley cañon, 2 miles above metering section ; read daily.

Channel—One channel at all stages ; straight above and below section ; stream bed appears to be permanent. Depth of water at the section is influenced, at some stages, by backwater from the Skeena.

Discharge measurements—Six measurements in open season.

Winter flow—The river freezes over early in December. Frazil and anchor ice remain in the river for a large part of the winter.

* Revised value based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					Oct. 22	1,304	4·80	11·3	6,260
July 14	1,890	6·11	18·4	11,580	1916 [1]				
Aug. 27	1,460	5·50	13·5	8,160	Aug. 6	....	....	16·0	10,080
Sept. 25	1,210	4·47	11·0	5,410	Aug. 24	....	....	16·0	13,060

[1] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 356.

MONTHLY SUMMARIES

The data obtained at the end of 1916 were not sufficient to warrant the computation of daily discharges and monthly summaries.

17—BULKLEY RIVER—near Hubert

Drainage area, about 2,500 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge near Hubert, and about 3 miles above the mouth of Telkwa river.

Records available—July 8 to Dec. 31, 1915.

Gauge—Vertical staff gauge, nailed on upstream side of pier at south end of bridge. Read daily.

Channel—Divided into three sections by bridge piers. Straight for 250 feet above and below. Section is influenced by a curve in the channel about 300 feet above the bridge.

Discharge measurements—Four measurements during the open season of 1915. Four in 1916.

Winter flow—The river freezes over about the end of November. Ice jams, frazil and anchor ice affect the winter flow.

Accuracy—For gauge heights above 2·5, results should be within 15 per cent. Below 2·5 results are probably within 20 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					1916 [2]				
July 8	1,450	5·11	4·80	7,420	April 24	....	....	2·34	2,050
Aug. 30	1,130	4·31	3·87	4,880	May 14	....	....	4·80	6,710
Sept. 27	835	3·69	2·95	3,080	Aug. 9	....	....	5·10	6,160
Oct. 25	790	3·78	2·75	2,980 [1]	" 23	....	....	4·80	5,810

[1] Snowing. [2] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 356.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1915					
Aug.	....	....	....	....	....	Aug.	7,740	4,770	6,310	2·52	2·90
Sept.	....	....	....	....	....	Sept.	4,770	3,150	3,960	1·58	1·76
Oct.	....	....	....	....	....	Oct.	3,150	2,700	2,850	1·14	1·32
Nov.	....	....	....	....	....	Nov.	2,700	1,350	1,920	0·77	0·86
Dec.	....	....	....	....	....	Dec.	1,350	980	1,060	0·42	0·48

18—BUNTZEN LAKE

Drainage area, 7 square miles

The following averages have been compiled from records supplied by the British Columbia Electric Railway Co.

AVERAGE RATE OF RUNOFF FROM LAKE BUNTZEN WATERSHED

Year	1906	1907	1908	1909	1910	1911	1912	1913
Second-feet	57	44	46	44	47	41	45	44
Second-feet per square mile	8·1	6·3	6·6	6·3	6·7	5·9	6·4	6·3

* Revised value based on recent measurements.

MEAN MONTHLY RUNOFF FOR YEAR 1913

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
Sec.-ft.	84	48	45	27	36	32	17	12	32	47	107	41	44
Sec.-ft. per sq. mile	12·0	6·9	6·4	3·9	5·1	4·6	2·4	1·7	4·6	6·7	15·3	5·9	6·3

19—CAMPBELL RIVER—at outlet of lake

Drainage area, 600 square miles*

DESCRIPTION OF GAUGING STATION

Location—At outlet of Lower Campbell lake.

Records available—Gauge readings by the Campbell River Power Co. from May 10, 1910.† On June 2, 1914, a new station was established by the British Columbia Hydrometric Survey.

Drainage area—600 sq. miles above outlet Lower Campbell lake ; above mouth 700 sq. miles.

Gauge—The Campbell River Power Co. established six vertical staff gauges ; British Columbia Hydrometric Survey have one 12-ft. enamel staff gauge, located near outlet from lake and 1,000 feet above metering section ; read twice daily.

Channel—Gravel and boulder bed ; channel straight for 300 feet above section ; rapids 100 feet below.

Discharge measurements—Made from cable car.

Winter flow—Open all winter.

Accuracy—Monthly summaries, as given below for all years, embody revisions based on recently revised rating curve, and accuracy is considered good ; additional measurements may, however, necessitate some further small revision. See NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
June 2	1,170	4·1	2·95[1]	4,750[2]
July 20	1,250	3·8	3·13[1]	4,710
Sept. 6	36	2·7	0·32[1]	977
Nov. 13	2,00	6·1	6·58[1]	12,200[3]
1915				
May 16	872[4]	4·25	3·74[5]	3,710
Aug. 6	490	2·60	1·60	1,260
Oct. 9	455	1·84	1·15	836
Oct. 11	425	1·68	1·01	716
" 26	1,267	6·46	6·45	8,180
" 27	1,520	7·57	8·10	11,500
1916				
April 11	957	5·04	4·28	4,820
Aug. 3	840	4·03	3·50	3,390
" 24	603	3·16	2·20	1,910
Oct. 24	333	1·36	0·60	454
" 25	336	1·37	0·60	46C

[1]Gauge heights for 1914 should be increased by 1·00 feet to compare with 1915 measurements.
[2]Station established. [3] Partly estimated. [4] Revised. [5] Gauge lowered 1·0 ft. New section for 1915 measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June					
July					
Aug.					
Sept.					
Oct.					
Nov.					
Dec.					
Period					

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1910					
June	6,040	2,780	4,670	7·78	8·68
July	6,580	2,780	4,130	6·88	7·92
Aug.	2,840	1,050	2,000	3·33	3·83
Sept.	1,010	730	867	1·44	1·61
Oct.	10,900	930	3,830	6·38	7·35
Nov.	9,300	1,750	4,940	8·23	9·20
Dec.	5,500	1,950	3,500	5·83	6·71
Period	10,900	730	3,420	5·70	45·30

* Revised value based on recent measurements.

† The Campbell River Power Co. established gauges at five points on the lower river and also a gauge near the outlet of Lower Campbell lake. The relative positions of the river gauges are shown on a plan entitled "Plan of Campbell River Power Company, Hydro-Electric Power Scheme" (No. 183A), filed with the Provincial Water Rights Branch at Victoria.

When the new gauge was established by the British Columbia Hydrometric Survey, a careful analysis was made of the records from the Campbell River Company's gauges. It was found possible to produce a reliable set of gauge readings to the same datum as the British Columbia Hydrometric Survey gauge.

MONTHLY SUMMARIES—*Continued*

1911

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	1,850	1,130	1,570	2·62	3·01
Feb.	1,550	770	988	1·65	1·71
Mar.	2,160	690	1,200	2·00	2·31
April	2,050	1,370	1,660	2·77	3·07
May	4,780	2,000	3,410	5·68	6·54
June	7,500	3,550	5,370	8·95	9·98
July	4,700	2,960	3,970	6·62	7·62
Aug.	2,840	1,130	1,720	2·87	3·30
Sept.	2,210	930	1,420	2·37	2·65
Oct.	4,540	730	2,070	3·45	3·96
Nov.	10,700	970	3,970	6·62	7·39
Dec.	5,100	2,380	3,630	6·05	6·96
Year	10,700	690	2,580	4·30	58·50

1912

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	8,900	1,130	3,470	5·78	6·65
Feb.	8,500	1,550	4,220	7·03	7·59
Mar	1,450	810	1,000	1·67	1·93
April	1,290	970	1,110	1·85	2·07
May	4,540	1,370	3,120	5·20	5·99
June	3,760	2,270	3,060	5·10	5·69
July	2,780	1,290	1,730	2·88	3·32
Aug.	1,250	930	1,120	1·87	2·16
Sept	1,450	650	1,010	1·68	1·87
Oct.	2,050	1,450	1,200	2·00	2·30
Nov.	12,600	1,450	5,340	8·90	9·93
Dec.	3,900	1,550	2,390	3·98	4·58
Year	12,600	650	2,400	4·00	54·08

1913

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	2,780	890	1,410	2·35	2·70
Feb.	3,620	890	1,700	2·83	2·93
Mar.	1,450	1,090	1,290	2·15	2·48
April	3,270	1,130	2,120	3·53	3·93
May	5,260	1,600	3,110	5·18	5·96
June	8,100	4,380	5,830	9·72	10·85
July	6,400	3,340	4,460	7·43	8·57
Aug.	3,140	1,290	2,030	3·38	3·89
Sept.	2,490	1,050	1,660	2·77	3·08
Oct.	3,900	1,210	2,200	3·67	4·24
Nov.	9,300	1,290	4,010	6·68	7·45
Dec.	7,300	1,850	3,640	6·07	6·99
Year	9,300	890	2,790	4·65	63·07

1914

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	8,700	1,750	4,540	7·57	8·72
Feb.	2,160	1,050	1,350	2·25	2·34
Mar.	5,860	2,430	4,060	6·77	7·80
April	7,900	2,720	5,190	8·65	9·65
May	6,940	3,140	4,830	8·05	9·28
June	7,030	3,340	4,630	7·72	8·61
July	5,650	2,030	3,980	6·63	7·63
Aug.	2,030	1,230	1,730	2·88	·31
Sept.	2,380	930	1,420	2·37	·65
Oct.	18,140	1,130	6,620	11·03	12·70
Nov.	14,740	3,720	8,740	14·57	16·27
Dec.	8,200	910	2,360	3·93	4·53
Year	18,140	910	4,120	6·87[1]	93·49

1915

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	2,720	850	1,650	2·75	3·16
Feb.	2,160	930	1,650	2·75	2·85
Mar.	7,460	1,220	3,250	5·42	6·24
April	8,600	2,350	4,290	7·15	7·98
May	4,220	2,000	3,150	5·25	6·04
June	3,340	1,800	[illegible]	4·27	4·76
July	2,360	1,290	[illegible]	2·83	3·25
Aug.	1,290	930	1,040	1·73	2·00
Sept.	970	450	650	1·08	1·20
Oct.	19,200	450	4,460	7·43	8·56
Nov.	13,700	1,850	3,940	6·57	7·33
Dec.	5,420	1,900	[illegible]	5·50	6·33
Year	19,200	450	[illegible]	4·40	59·70

1916

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.	1,720	610	925	1·54	1·78
Feb.	6,400	570	2,510	4·18	4·50
Mar.	14,800	2,490	5,330	8·88	10·24
April	4,650	2,550	3,720	6·20	6·92
May	6,310	3,270	4,710	7·85	9·05
June	10,700	5,050	7,060	11·77	13·12
July	6,310	3,480	5,220	8·70	10·03
Aug.	3,370	1,750	2,409	4·00	4·61
Sept.	1,900	750	1,210	2·02	2·25
Oct.	1,390	450	574	0·96	1·11
Nov.	2,460	970	1,600	2·82	3·15
Dec.	1,750	770	1,180	1·97	2·27
Year	14,900	450	3,040	5·07	69·03

[1] 1914 was apparently a year of exceptional precipitation over the central portion of Vancouver Island. See Precipitation Records for this locality, also compare Stream Flow Records of Big Qualicum river.

20—CAPILANO CREEK—6 miles from mouth

Drainage area, 64 square miles

DESCRIPTION OF GAUGING STATION

Location—Just above the Vancouver Waterworks intake ; about 6 miles fror he mouth.

Records available—Nov., 1913, to Dec., 1916.

Co-operation—Gauge readings taken by employees of the Vancouver waterworks department.

Drainage area—64 sq. miles, a revised estimate by the engineers of the Provincial Water Rights Branch.

Gauge—Vertical staff ; read twice a day.

Channel—Rocky bed ; water swift at high stages. At low water, a small temporary dam is sometimes placed in the channel below the gauge. Gauge readings are corrected to allow for the backwater caused by dam. A subsidiary gauge has been installed for low water stages, beyond the effect of this dam.

Discharge measurements—Well define the rating curve.

Winter flow—Open water all year.

Accuracy—C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1909				
Aug. 4	....	....	....	318
1913				
Nov. 6	196	2·04	0·90	400
1914				
April 23	344	2·17	5·10	745
May 28	354	2·10	5·15	717
June 19	343	1·91	5·10	633
Aug. 13	92	1·10	4·10	100[1]
Sept. 9	95	1·10	4·70	102[1]
Oct. 8	115	1·66	4·05	191
Oct. 19	529	7·85	7·70	4,100
" 26	206	2·00	4·40	407
1915				
April 13	300	4·90	5·95	1,481
June 11	240	1·50	4·20	359
" 25	97	1·80	2·00	176
Aug. 4	61	1·05	1·40	64[2]
Dec. 22	320	2·75	3·25	866
1916				
Sept. 11	70	0·97	1·52	69[3]

[1] Affected by backwater from dam. [2] New gauge installed above intake on August 4. [3] Wading measurement.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Year	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	9,420	510	2,190	34·22	39·48
Feb.	2,860	410	877	13·70	14·26
Mar.	4,190	410	1,190	18·60	21·45
April	3,030	410	1,160	18·14	20·25
May	1,720	560	1,170	18·29	21·09
June	1,600	430	905	14·13	15·77
July	1,260	110	393	6·14	7·06
Aug.	215	75	115	1·80	2·08
Sept.	5,660	40	643	10·05	11·22
Oct.	9.020	220	1,680	26·26	30·26
Nov.	6,620	250	1,645	25·72	28·70
Dec.	710	60	226	3·53	4·05
Year	9,420	40	1.018	15·90	215·67
1915					
Jan.	4,620	160	645	10·08	11·62
Feb.	1,920	250	655	10·23	10·65
Mar.	5,020	280	1,022	15·97	18·41
April	9,620	375	1,487	23·21	25·89
May	1,540	310	704	11·00	12·68
June	540	150	305	4·77	5·32
July	210	65	138	2·16	2·49
Aug.	65	45	53	0·83	0·96
Sept.	110	35	50	0·78	0·87
Oct.	4,620	45	1,200	18·76	21·63
Nov.	1,230	240	540	8·44	9·42
Dec.	8,620	210	1,100	17·19	19·81
Year	9,620	35	658	10·29	139·75
1916					
Jan.	600	100	[illegible]5	2·73	3·15
Feb.	8,960	100	1,190	18·60	20·10
Mar.	4,670	240	1,240	19·40	22·40
April	1,960	480	927	14·40	16·10
May	2,460	540	1,210	18·90	21·80
June	2,590	890	1,550	24·20	27·00
July	3,630	600	1,230	19·20	22·10
Aug.	540	180	330	5·15	5·94
Sept.	210	65	98	1·53	1·71
Oct.	1,840	45	166	2·60	3·00
Nov.	3,240	150	526	8·22	9·17
Dec.	4,020	80	345	5·40	6·23
Year	8,960	45	749	11·70	158·70

21—CAYUSE CREEK—2 miles from mouth

Drainage area, 350 square miles

DESCRIPTION OF GAUGING STATION

Location—At the Pacific Great Eastern Ry. trestle ; 2½ miles from Lillooet.

Records available—April 8, 1914, to Dec. 31, 1916.

Gauge—Vertical staff on pile in the trestle ; read daily.

Channel—Wide and of moderate depth, strewn with boulders and coarse gravel. The current is very swift, especially at the higher stages.

Discharge measurements—Are made at a good section and well define the rating curve, except at extreme stages. New rating curve in 1916.

Winter flow—Affected by ice conditions during the winter months.

Accuracy—Good, except possibly at extreme stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					June 15	316	5·00	2·30	1,860
April 8	171	2·29	0·70	392[1]	Aug. 6	236	4·57	1·60	1,080
June 13	326	6·53	2·30	2,131	Dec. 2	143	1·35	0·34	193
" 19	410	8·30	2·70	3,410	1916				
Aug. 1	275	3·49	1·60	957	April 30	194	2·07	0·85	401
Sept 17	213	1·93	0·79	412	June 10	275	5·97	2·00	1,640
1915					" 26	490	11·14	3·95	5,470
Feb. 13	167	0·92	0·14	153	Sept. 25	212	2·26	0·97	479
May 8	328	6·00	2·25	1,950	Dec. 9	136	1·20	0·22	164

[1]Station established.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
May....	....	....	....	..	....
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug.....	....	....	....	....	....
Sept.....	....	....	....	....	....
Oct.....	....	....	....	....	....
Nov.....	....	....	....	....	....
Dec.	....	....	....	....	....
Period...	....	....	....	....	....
1915					
Jan.....	475	125	193	0·55	0·63
Feb.....	180	150	157	0·45	0·47
Mar	300	150	213	0·61	0·70
April	1,000	280	624	1·78	1·99
May....	2,140	700	1,240	3·54	4·08
June....	2,710	950	1,690	4·83	5·39
July....	2,420	950	1,470	4·20	4·84
Aug.....	1,185	700	910	2·60	3·00
Sept.....	775	325	450	1·29	1·44
Oct	700	260	370	1·06	1·22
Nov.....	475	220	295	0·84	0·94
Dec.....	240	150	190	0·54	0·62
Year....	2,710	125	650	1·86	25·32

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
May ..	3,400	480	1,616	4·62	5·32
June...	6,550	1,350	2,833	8·10	9·03
July...	6,000	850	2,915	8·33	9·60
Aug....	1,050	640	818	2·34	2·70
Sept....	780	420	548	1·56	1·74
Oct....	1,000	470	603	1·72	1·98
Nov....	630	380	475	1·36	1·52
Dec....	420	240	298	0·85	0·98
Period..	6,550	240	1,263	3·61	32·87
1916					
Jan.[1] ..	....	.....	125	0·36	0·42
Feb.[1]...	.....	.....	126	0·36	0·39
Mar...	440	105	255	0·73	0·84
April...	415	260	297	0·84	0·94
May...	1,500	500	939	2·68	3·09
June..	6,000	1,110	3,330	9·52	10·60
July...	4,080	1,840	3,230	9·23	10·60
Aug....	2,600	1,660	2,080	5·94	6·85
Sept....	1,660	155	649	1·86	2·08
Oct.[2] ..	.....	.....	300	0·86	0·99
Nov....	260	155	199	0·57	0·64
Dec....	175	145	163	0·47	0·54
Year...	6,000	105	975	2·79	37·98

[1]Gauge height-discharge relation affected by ice, and discharge estimated from gauge heights and climatic conditions Jan. 5 to Feb. 11, 120 c.f.s. [2]Monthly mean discharge estimated by interpolation.

22—CHEAKAMUS RIVER—near mouth

Drainage area, 250 square miles

DESCRIPTION OF GAUGING STATION

Location—At highway bridge, about 1 mile from the mouth and 10 miles from Squamish.
*Records available**—Mar. 11, 1914, to Dec. 30, 1915 ; except period Nov. 1 to Dec 6, 1915.
Gauge—Cable gauge from highway bridge ; referenced to three bench marks ; read daily.
Channel—Wide and shallow ; bed is rough and strewn with boulders.
Discharge measurements—Are made from the bridge.
Winter flow—Open water conditions.
Accuracy—B and C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					1915				
Nov. 29	448	5·97	4·30	2,640	Feb. 2	245	3·02	1·55	738
1914					" 24	233	3·20	1·70	746
May 21	555	7·87	4·30	4,370	May 28	444	7·00	3·15	3,010
June 23	490	5·80	3·60	2,840	June 10	467	5·30	3·40	2,500
Sept. 2	383	5·38	3·28	2,060	" 12	502	5·24	3·92	2,634
Oct. 8	300	4·67	2·35	1,400	Aug. 18	560	6·07	4·10	3,400
Nov. 24	473	2·96	3·75	2,410[1]	Dec. 8	470	5·71	3·10	2,690

[1]Channel may have changed during freshet in October.

*Some records for June to Dec., 1913, are published in *Reports of the Water Rights Branch*, Victoria, B.C., for year 1913, p. 133 ; these results now are not considered reliable.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	5,550	1,150	2,618	10·47	11·68
May	6,750	2,450	4,250	17·00	19·60
June	8,120	2,080	4,333	17·33	19·33
July	8,250	2,450	5,020	20·08	23·15
Aug.	4,600	2,300	3,200	12·80	14·76
Sept.	6,170	1,190	2,011	8·04	8·97
Oct.	14,500	1,070	4,080	16·32	18·81
Nov.	8,620	950	3,338	13·35	14·89
Dec.	1,770	550	790	3·16	3·64
Period	14,500	550	3,290	13·16	134·83

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
Jan.	1,070	450	612	2·45	2·83
Feb.	920	550	725	2·90	3·02
Mar.	4,600	800	1,440	5·76	6·64
April	12,880	1,430	3,450	13·80	15·40
May	3,750	1,280	2,530	10·12	11·66
June	4,600	1,380	3,270	13·08	14·59
July	6,250	3,350	4,320	17·30	19·90
Aug.	5,300	3,550	3,960	15·80	18·20
Sept.	4,850	1,650	2,180	8·72	9·73
Oct.	9,125	990	2,930	11·72	13·51
Nov.[1]	....	....	....	....	....
Dec.[2]	2,300	750	....	....	....
Period	12,880	450	2,540	10·17	115·48

[1] No record. [2] Dec. 7 to 30.

23—CHEHALIS RIVER—near mouth

Drainage area, 200 square miles*

DESCRIPTION OF GAUGING STATION

Location—1½ miles from mouth, in sec. 14, tp. 4, rge. 30, W. 6th mer.

Records available—Nov and Dec., 1911 ; Mar., 1912, to May, 1915. Gauge readings ceased June 8, 1915.

Gauge—Chain gauge read daily.

Channel—Rocky bed ; water swift at higher stages.

Discharge measurements—Are made by wading, except at high water, when a canoe is employed.

Winter flow—Open water all year.

Accuracy—Below 3,000 sec. ft. accuracy B ; above 3,000 sec. ft. accuracy C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911				
Nov. 3	127	1·05	0·85	133[1]
Dec. 11	273	3·74	3·80	1,021[2]
1912				
Mar. 8	162	1·82	2·70	295[3]
July 5	221	2·42	3·07	535
Sept. 11	248	2·40	2·90	594
Nov. 23	600	4·85	4·95	2,910
Dec. 4	343	3·56	3·92	1,220
1913				
May 21	460	3·90	4·40	1,810
Sept. 8	395	3·95	4·40	1,560
1914				
May 22	423	4·20	4·50	1,730
Aug. 25	180	1·10	2·60	188
1915				
Mar. 6	273	2·30	3·7	623

[1] Old staff gauge. [2] New staff gauge. [3] Chain gauge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
1912					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.[2]	355	200	248	1·24	1·4
April	650	302	425	2·12	2·3
May	1,270	502	904	4·52	5·2
June	1,270	580	760	3·80	4·2
July	556	210	386	1·93	2·2
Aug.	1,610	160	310	1·55	1·7
Sept.	1,330	130	390	1·95	2·1
Oct.	1,610	135	631	3·15	3·6
Nov.	5,250	550	2,127	10·63	11·8
Dec.	2,620	410	999	5·00	5·8
Period	5,250	130	718	3·59	4·03

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Nov.[1]	9,500	290	2,173	10·8	12·0
Dec.[1]	4,550	810	1,598	8·0	9·2
1913					
Jan.	1,230	270	551	2·76	3·18
Feb.	1,500	340	1,350	6·75	7·03
Mar.	3,100	580	1,084	5·42	6·25
April	3,450	710	1,465	7·32	8·17
May	5,550	1,100	2,460	12·30	14·18
June	2,200	1,430	1,693	8·47	9·45
July	1,550	450	916	4·58	5·28
Aug.	750	230	441	2·20	2·54
Sept.	4,850	250	1,010	5·05	5·63
Oct.	7,700	270	1,765	8·82	10·17
Nov.	15,000	420	3,295	16·48	18·40
Dec.	4,350	820	1,615	8·08	9·32
Year	15,000	230	1,467	7·35	99·60

* Approximate, possibly somewhat greater.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	22,000	980	4,230	21·15	24·37
Feb.	4,350	900	1,570	7·85	8·17
Mar.	10,100	1,430	3,800	19·00	21·90
April	12,000	1,750	3,610	18·05	20·13
May	3,100	1,320	1,980	9·90	11·41
June	1,320	860	1,130	5·65	6·30
July	1,060	350	690	3·45	3·98
Aug.	350	150	270	1·35	1·56
Sept.	5,800	120	990	4·95	5·52
Oct.	9,600	600	2,040	10·20	11·76
Nov.	10,100	1,230	4,480	22·40	25·00
Dec.	2,200	320	730	3·65	4·21
Year	22,000	120	2,130	10·65	144·30

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
Jan.	2,750	470	1,040	5·20	6·00
Feb.	1,140	670	930	4·65	4·84
Mar.	5,300	630	1,380	6·90	7·95
April	6,700	750	1,800	9·00	10·04
May	1,550	670	900	4·50	5·19
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	6,700	470	1,210	6·05	34·02

[1] Partly estimated. [2] March 7 to 31.

24—CHEMAINUS RIVER—near mouth

Drainage area, 120 square miles

DESCRIPTION OF GAUGING STATION

Location—Near Esquimalt and Nanaimo Ry. bridge.

Records available—May 13, 1914, to Dec. 31, 1916.

Gauge—Eighteen-foot wooden staff on left bank, 100 feet below bridge. Installed by Provincial Water Rights Branch in 1911 ; read daily.

Channel—Straight for 150 feet above and 300 feet below section ; gravel and sand bed. Control changed in February, 1916.

Discharge measurements—Are made from the bridge, or, at lower stages, by wading.

Winter flow—Generally open all winter, but, in Jan. and Feb., 1916, stream was frozen for some weeks.

Accuracy—Up to discharge of 600 sec. ft., accuracy A ; between discharge of 600 and 2,000 sec. ft., accuracy B ; above discharge of 2,000 sec. ft., accuracy C. The 1916 rating curve is not well defined.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Dec. 19	303	1·9	0·96	575 [1]
1913				
Feb. 3	335	1·2	0·81	397 [1]
1914				
May 13	530	1·1	3·79	555 [2]
July 6	402	0·2	2·58	93·6 [3]
" 6	37	2·4	2·58	88·3
Aug. 11	19	1·4	2·16	26·2
" 28	16	1·0	2·03	16·3
Nov. 26	711	2·7	5·20	1,890
1915				
Mar. 24	531	1·80	4·15	935
Aug. 31	16	0·67	1·93	10·8 [4]
Dec. 10	665	2·50	5·17	1,650
1916				
Mar. 28	703	1·74	4·99	1,220
Nov. 4	741	2·31	5·44	1,710
Dec. 15	556	0·76	4·13	421
1917				
Jan.	491	0·43	3·79	210 [5]

[1] Metered from railway bridge. [2] Station established. [3] Several sections used. [4] Not at regular section. [5] Ice along shore.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
June	340	140	200	1·67	1·86
July	140	35	75	0·62	0·72
Aug.	35	15	25	0·21	0·24
Sept.	460	14	110	0·92	1·03
Oct.	5,850	120	1,320	11·00	12·68
Nov.	4,560	520	2,200	18·33	20·45
Dec.	1,760	190	435	3·62	4·17
Period	5,850	14	624	5·20	41·15

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1915						1916		
Jan.	3,760	240	916	7·63	8·80	Jan.[1]	546	190	277	2·31	2·66
Feb.	1,400	450	713	5·94	6·18	Feb.[1]	6,080	190	1,370	11·40	12·30
Mar.	3,700	350	840	7·00	8·07	Mar.	3,550	510	1,400	11·70	13·50
April	5,580	190	932	7·76	8·66	April	2,340	911	1,300	10·80	12·10
May	330	190	253	2·11	2·43	May	2,240	582	1,180	9·84	11·30
June	260	80	148	1·23	1·37	June	1,840	510	970	8·08	9·02
July	72	40	58	0·48	0·55	July	640	192	343	2·86	3·30
Aug.	44	15	24	0·20	0·23	Aug.	200	23	54	0·45	0·52
Sept.	20	11	15	0·13	0·14	Sept.	26	14	20	0·17	0·19
Oct.	4,520	15	795	6·63	7·64	Oct.	1,340	17	61	0·51	0·59
Nov.	2,760	210	897	7·47	8·33	Nov.	1,340	107	477	3·98	4·44
Dec.	6,130	570	1,810	15·10	17·40	Dec.	1,230	200	430	3·59	4·14
Year	6,130	11	617	5·14	69·80	Year	6,080	14	657	5·48	74·06

[1] Gauge height-discharge relation affected by ice Jan. 15 to Feb. 7, also possibly on Feb. 15 and 16.

25—CHILLIWACK RIVER—5 miles above Sumas lak[illegible] Drainage area, 450 square miles

DESCRIPTION OF GAUG[illegible]

Location—5 miles above Sumas lake, in sec. 1, tp. 23, east of C[illegible]ridian.

Records available—Nov. 16, 1911, to Dec., 1915.[a]

Drainage area—450 sq. miles, of which about 100 sq. miles is in the state of Washington.

Gauge—Vertical staff on rock-filled crib ; read daily.

Channel—Rocky bottom, good control ; water deep, swift at high stages. Single channel, banks protected by cribbing.

Discharge measurements—Made from a canoe or by cable carrier.

Winter flow—Open water all year.

Accuracy—A.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1914				
Dec. 18	451	2·61	1·70	1,180	Jan. 10	816	5·47	3·65	4,450
1912					" 13	718	4·31	2·80	3,090
Mar. 21	424	1·76	1·00	750	" 12	740	4·49	2·98	3,320
" 22	508	1·52	1·00	770	" 15	790	3·70	2·70	2,920
July 8	658	4·69	2·90	3,090	" 17	780	3·27	2·54	2,550
Aug. 30	552	2·03	1·60	1,120	" 22	665	3·04	2·27	2,020
Nov. 21	684	5·32	3·15	3,540	" 23	718	2·63	2·05	1,893
1913					1915				
June 5	969	8·90	5·00	8,640	April 26	415	5·30	2·40	2,210
July 13	710	7·41	4·05	5,270					

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
									1911		
Dec.	....	....	....	....	....	Dec.	2,259	970	1,462	3·2	3·7
			1912						1913		
Jan.	4,340	810	1,518	3·37	3·87	Jan.	1,360	960	1,208	2·68	3·09
Feb.	3,020	1,040	1,870	4·15	4·46	Feb.	10,100	815	1,942	4·31	4·49
Mar.	1,040	770	865	1·92	2 21	Mar.	1,160	1,020	1,064	2·37	2·73
April	1,120	860	980	2·18	2·43	April	3,260	960	1,557	3·47	3·87
May	8,800	1,120	4,581	10·19	11·74	May	8,900	1,500	4,416	9·81	11·31
June	9,050	3,650	6,387	14·20	15·85	June	12,200	5,920	4,779	10·62	11·85
July	5,530	1,620	3,089	6·87	7·91	July	8,100	3,620	5,724	12·72	14·64
Aug.	2,070	1,120	1,386	3·08	3·55	Aug.	3,440	1,250	2,303	5·12	5·90
Sept.	1,500	770	956	2·12	2·37	Sept.	8,500	1,250	2,664	5·93	6·62
Oct.	1,290	770	893	1·98	2·28	Oct.	10,500	960	2,770	6·16	7·10
Nov.	7,040	860	2,347	5·22	5·82	Nov.	5,360	1,500	2,533	5·63	6·28
Dec.	1,750	1,040	1,232	2·74	3·16	Dec.	2,750	960	1,557	3·46	3·99
Year	9,050	770	2,175	4·80	65·65	Year	12,200	815	2,710	6·02	81·87

[a] Records were taken during 1916, but were found to contain errors. See *Water Resources Paper No. 21*, p. 38.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1914						1915				
Jan......	20,000	900	4,280	9·52	10·98	Jan....	1,400	800	1,040	2·31	2·66
Feb......	1,550	1,000	1,170	2·60	2·71	Feb....	900	800	850	1·89	1 97
Mar......	3,070	1,400	2,250	5·00	5·76	Mar....	2,500	820	1,350	3·00	3·46
April....	4,600	1,700	3,110	6·92	7·72	April..	8,700	1,550	3,650	7·45	8·31
May......	5,800	2,650	4,170	9·28	10·70	May....	4,000	2,000	2,740	6·09	7·02
June.....	5,900	2,800	4,000	8·90	9·93	June...	3,300	1,620	2,320	5·16	5·76
July.....	4,600	1,770	3,140	6·98	8·05	July...	2,150	1,000	1,600	3·55	4·09
Aug......	1,700	1,000	1,320	2·93	3·38	Aug....	1,200	950	1,066	2·37	2·73
Sept.....	2,500	850	1,310	2·91	3·25	Sept....	950	800	859	1·91	2·13
Oct......	2,650	950	1,510	3·36	3·87	Oct....	9,350	825	2,150	4·78	5·51
Nov......	5,000	2,220	3,080	6·85	7·64	Nov....	6,100	1,400	2,450	5·45	6·08
Dec......	3,000	850	1,340	2·98	3·44	Dec....	5,800	1,300	2,190	4·87	5·62
Year....	20,000	850	2,560	5·69	77·43	Year...	9,350	800	1,830	4·07	55·34

26—CLEARWATER RIVER—near mouth

Drainage area, 4,100 square miles*

DESCRIPTION OF GAUGING STATION

Location—Near Raft river.

Records available—Mar., 1914, to Dec., 1916.

Gauge—Standard chain gauge ; read daily ; gauge, in 1914, was ¼ mile below measuring section ; new gauge, installed in spring of 1915, is 50 feet below measuring section. Standard, tape-wound, steel cable gauge installed Oct. 17, 1916. Readings daily.

Channel—Varies in width from 100 to 400 feet and passes over several small falls and rapids. Bed, large boulders and gravel.

Discharge measurements—Made from cable car at section 500 feet above gauge.

Winter flow—Ice conditions for about three months.

Accuracy—Good ; rating curve is good and condition for metering excellent. Monthly summary given below for 1914 embodies revisions based on later measurements. See NOTE page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					1915				
April 16	2,043	2·04	0·57[1]	4,170	Mar. 12	1,373	0·76	3·5[7]	1,050
May 30	2,778	5·84	4·8[2]	16,227[9]	April 28	2,382	3·45	8·2[8]	8,230
" 31	2,735	5·75	4·6[3]	15,739[9]	1916				
June 1	2,667	5·56	4·1[4]	14,854[9]	June 26	3,688	8·10	13·55	29,864
" 12	2,890	6·8	5·3	19,650[9]	Sept. 15	2,074	2·60	7·01	5,394
" 15	3,049	7·63	6·0	23,292[9]	Oct. 27	1,860	1·97	5·90	3,661
" 16	3,174	7·93	6·5	25,165[9]	1917				
" 17	3,300	7·78	7·0	25,703[9]	Feb. 19	1,653	0·77	Ice	1,281
July 25	2,599	5·66	4·2[5]	14,717[9]					
Sept. 19	2,022	2·61	1·29[6]	5,283					

NOTE.—Gauge height, new gauge, as follows : [1] 5·8. [2] 10·7. [3] 10·4. [4] 10·0. [5] 10·1. [6] 6·6. [7] New gauge installed Mar. 13, gauge height, old gauge, −1·50. [8] Gauge height, old gauge, 2·70.
[9] Surface velocity measurement, co-efficient 0·89.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1913						1914				
April...	....	....	....	....	....	April...	5,650	3,040	4,756	1·16	1·29
May....	....	....	....	....	....	May...	22,600	6,100	15,494	3·78	4·37
June....	....	....	....	....	....	June...	27,950	14,475	21,567	5·26	5·89
July....	....	....	....	....	....	July...	23,050	13,675	19,122	4·67	5·38
Aug.....	....	....	....	....	....	Aug....	13,225	7,012	9,328	2·27	2·62
Sept....	....	....	....	....	....	Sept....	10,150	4,810	6,428	1·57	1·75
Oct.....	....	....	....	....	....	Oct....	10,150	4,540	5,914	1·44	1·66
Nov.....	....	....	....	....	....	Nov....	5,260	3,040	3,874	0·94	1·05
Dec.....	....	....	....	....	....	Dec....	3,040	1,720	2,202	0·54	0·62
Period...	....	....	....	....	....	Period..	27,950	1,720	9,854	2·40	24·63

* Revised value based on recent measurements.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
Jan.	1,740	1,040	1,445	0·35	0·40
Feb.	1,330	950	1,163	0·28	0·29
Mar.	2,120	950	1,354	0·33	0·38
April	9,600	2,380	6,603	1·61	1·80
May	20,100	9,600	16,234	3·96	4·59
June	16,400	12,400	14,580	3·56	4·00
July	18,800	14,300	15,668	3·82	4·42
Aug.	15,900	11,700	13,565	3·31	3·82
Sept.	11,600	4,160	6,611	1·61	1·80
Oct.	5,160	3,350	4,014	0·98	1·13
Nov.	5,160	2,650	3,716	0·91	1·01
Dec.	2,860	2,250	2,496	0·61	0·70
Year	20,100	950	7,287	1·78	24·34
1916					
Jan.	1,920	1,630	1,790	0·44	0·51
Feb.	1,630	1,490	1,570	0·38	0·41
Mar.	1,870	1,170	1,380	0·34	0·39
April	5,180	1,770	2,930	0·72	0·80
May	14,070	5,360	10,830	2·65	3·06
June	33,160	13,690	22,200	5·42	6·05
July	25,880	14,070	19,750	4·82	5·56
Aug.	14,260	7,320	10,320	2·52	2·90
Sept.	8,760	3,850	5,620	1·42	1·58
Oct.	4,070	2,340	3,170	0·77	0·89
Nov.	2,940	1,580	2,160	0·53	0·59
Dec.	1,770	1,490	1,600	0·39	0·45
Year	33,160	1,170	6,960	1·70	23·19

27—COLUMBIA RIVER—near Trail

Drainage area, 34,000 square miles

DESCRIPTION OF GAUGING STATION

Location—15 miles above international boundary,—above mouth of Pend-d'Oreille river, below mouth of Kootenay, at the highway bridge near Trail.

Records available—April 18, 1913, to Dec. 31, 1916.

Co-operation—This station is now maintained in co-operation with the Water Resources Branch of the United States Geological Survey. It has supplied a standard chain gauge and a special type of sounding device for use in high-water.

Gauge—A chain gauge, 60·8 feet long, read daily, and during 1916 twice dai[illegible]

Channel—The river has a bend about 400 yards above the bridge, while below, t[illegible] is straight for 400 yards. The control, a pronounced riffle 100 yards below the bridge, ap[illegible] permanent.

Discharge measurements—Are made from the upstream side of the traffic bridge.

Winter flow—The river never freezes over ; station not affected by ice conditions.

Accuracy—The rating curve appears to be good. Accuracy B and C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912				
Dec. 18	6,640	2·79	10·5	18,600
1913				
Mar. 5	5,640	2·53	8·5	14,300
" 26	5,640	2·72	8·5	15,400[1]
May 1	9,360	6·3	15·4	58,700
" 21	11,200	7·3	19·0	82,200
June 11	23,900	12·4	40·2	297,000
July 4	20,100	10·9	34·5	219,000
" 21	15,800	9·63	27·6	152,000
Aug. 6	15,100	9·42	26·1	142,000
" 7	15,100	9·65	26·1	145,000[2]
Sept. 4	12,300	7·93	21·0	97,000
Nov. 5	7,630	4·86	13·1	37,100
1914				
Jan. 15	6,250	3·57	9·5	22,300
April 17	7,120	3·51	10·5	25,000
June 2	15,600	9·68	28·3	151,000
July 17	19,200	11·09	33·7	213,000
Nov. 11	9,110	5·43	14·6	49,000
1915				
Jan. 4	6,940	3·42	10·0	23,800
Feb. 11	6,290	2·74	8·8	17,100
June 4	14,400	8·69	24·7	125,000
Aug. 9	15,000	9·60	25·9	144,000
Dec. 23	6,160	3·10	10·2	19,100
1916				
Feb. 9	5,810	2·29	8·20	13,300
June 6	14,100	8·89	24·75	125,500
" 25	22,400	13·96	39·12	312,700
July 20	22,000	11·[illegible]0	37·65	262,000
Aug. 8	16,000	10·00	27·67	160,000
Sept. 6	13,000	8·34	22·63	109,000
" 28	9,990	6·31	16·60	63,100
Oct. 26	8,110	4·23	12·60	34,300
Nov. 28	7,040	3·23	10·30	22,800

[1] Strong wind down stream, not a reliable measurement.

[2] New gauge was established Aug. 7, 1913, when both gauges read 26′ 10″. On Nov. 5, old gauge read 12′ 6″, while new one read 13′ 1″. Difference caused by water piling up beside the pier, to which old gauge was fastened, during high water.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						**1914**					
Jan.....	....	....	....	....	....	Jan....	22,000	19,000	20,700	0·61	0·70
Feb.....	....	....	....	....	....	Feb....	18,600	15,500	16,800	0·49	0·51
Mar.....	....	....	....	....	....	Mar....	24,500	15,500	17,800	0·52	0·60
April....	....	....	....	....	....	April...	69,100	23,700	43,700	1·28	1·43
May....	165,000	56,800	86,400	2·54	2·93	May...	167,000	71,300	125,000	3·68	4·24
June....	312,000	191,000	262,000	7·70	8·59	June...	220,000	163,000	190,000	5·59	6·24
July....	236,000	150,000	181,000	5·32	6·13	July...	222,000	144,000	200,000	5·89	6·79
Aug.....	152,000	98,400	125,000	3·68	4·24	Aug....	140,000	87,200	112,000	3·29	3·79
Sept.....	98,400	62,100	83,500	2·46	2.75	Sept....	85,200	52,200	65,700	1·93	2·15
Oct.....	60,500	39,300	46,900	1·38	1·59	Oct....	54,100	44,400	46,300	1·36	1·57
Nov.....	39,300	27,800	32,300	0·95	1·06	Nov....	51,500	39,600	45,900	1·35	1·51
Dec.....	27,800	18,600	22,600	0·66	0·76	Dec....	39,000	22,500	30,500	0·90	1·04
Period...	312,000	18,600	104,960	3·09	28·05	Year...	222,000	15,500	76,233	2·24	30·57
1915						**1916**					
Jan.....	22,500	17,000	19,900	0·58	0·67	Jan....	20,500	13,000	16,300	0·48	0·55
Feb.....	17,000	16,000	16,400	0·48	0·50	Feb....	16,500	12,000	13,700	0·40	0·43
Mar.....	22,000	15,500	17,300	0·51	0·59	Mar....	33,400	16,000	23,000	0·68	0·78
April....	72,000	23,100	45,500	1·34	1·50	April...	57,700	34,000	45,000	1·32	1·47
May....	129,000	74,400	110,000	3·24	3·74	May...	118,000	59,800	99,400	2·92	3·37
June....	137,000	117,000	123,000	3·62	4·04	June...	306,000	119,000	192,000	5·65	6·30
July....	149,000	130,000	140,000	4·12	4·75	July...	304,000	192,000	262,000	7·70	8·88
Aug.....	139,000	119,000	132,000	3·88	4·47	Aug....	185,000	104,000	136,000	4·00	4·61
Sept.....	117,000	47,200	76,600	2·25	2·51	Sept....	108,000	59,100	86,700	2·55	2·84
Oct.....	45,900	34,000	38,200	1·13	1·30	Oct....	57,700	34,700	42,300	1·24	1·43
Nov.....	38,000	29,500	35,000	1·03	1·15	Nov....	34,300	23,100	29,100	0·85	0·95
Dec.....	29,500	21,500	25,400	0·75	0·86	Dec....	23,100	15,600	19,600	0·58	0·67
Year....	149,000	15,500	64,941	1·91	26·08	Year...	306,000	12,000	80,400	2·36	32·28

28—COLUMBIA RIVER—near Castlegar

Drainage area, 15,000 square miles

DESCRIPTION OF GAUGING STATION

Location—At the C.P. Ry. bridge near Castlegar, below Lower Arrow lake and above mouth of Kootenay river.

Records available—Dec., 1912, to Dec., 1915. Discontinued March, 1916.

Gauge—Vertical staff gauge was used till August, 1914, when a chain gauge was established; read daily.

Channel—Straight for 200 yards above and below the measuring section and gauge. A pronounced riffle in low water is lost during high water. The rise and fall of the river is about 25 feet.

Discharge measurements—Are made from the upstream side of the railway bridge.

Winter flow—River rarely freezes over.

Accuracy—This station was maintained chiefly to check the results obtained from Kootenay river near Glade and Columbia river near Trail. Due to a possibility of backwater these results may be somewhat in error. Monthly summaries given below for 1913 and 1914 embody revisions based on later measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913					July 28	13,500	7·67	17·52	104,000
June 14	20,100	7·88	28·2	158,500	Aug. 6	12,900	6·60	15·8	85,100
July 5	16,550	6·94	21·6	115,000	1915				
" 22	13,800	6·24	16·4	86,200	Feb. 28	6,510	1·21	0·70	7,920
Sept. 5	12,200	5·55	13·0	67,600	April 26	9,250	3·73	7·23	34,500
Nov. 25	7,730	2·04	3·2	15,800	May 6	10,200	4·28	9·30	43,700
1914					June 2	12,400	5·76	14·40	71,500
Jan. 14	6,800	1·66	1·7	11,300	1916[1]				
Mar. 5	6,170	1·24	0·72	7,680	Feb. 12	....	....	0·50	7,010
May 31	14,100	5·82	16·12	82,100					

[1] From "Miscellaneous Meter Measurements," *W. R. Paper No. 81*, p. 351.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1912		
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	14,700	12,900	13,800	0·92	1·06
Period	....	....	....	....	....
			1914		
Jan.	10,600	8,450	9,410	0·63	0·73
Feb.	8,200	7,210	7,740	0·52	0·54
Mar.	8,980	8,200	8,360	0·56	0·64
April	29,500	8,710	16,700	1·11	1·24
May	86,700	30,500	61,900	4·12	4·74
June	121,000	88,400	104,000	6·94	7·74
July	128,000	92,000	116,000	7·73	8·90
Aug.	89,000	56,400	69,200	4·61	5·31
Sept.	55,300	29,000	41,600	2·77	3·09
Oct.	34,200	23,200	28,100	1·87	2·16
Nov.	23,200	18,000	21,600	1·44	1·61
Dec.	19,200	9,820	14,100	0·94	1·08
Year	128,000	7,210	41,560	2·77	37·78

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1913		
Jan.	13,400	11,300	12,200	0·81	0·93
Feb.	9,390	7,450	8,650	0·58	0·60
Mar.	7,700	6,970	7,470	0·50	0·58
April	21,900	6,970	11,500	0·77	0·86
May	86,100	22,300	38,600	2·57	2·96
June	159,000	95,100	132,000	8·80	9·82
July	118,000	83,300	97,400	6·49	7·47
Aug.	86,100	60,700	76,100	5·07	5·84
Sept.	66,100	40,400	54,400	3·63	4·04
Oct.	38,800	23,200	28,500	1·90	2·19
Nov.	23,200	14,900	18,500	1·23	1·37
Dec.	14,600	9,820	12,400	0·83	0·96
Year	159,000	6,970	41,500	2·76	37·62
			1915		
Jan.	10,100	8,450	9,050	0·60	0·69
Feb.	8,450	7,950	8,120	0·54	0·56
Mar.	8,980	7,450	7,910	0·53	0·61
April	37,300	9,530	21,600	1·44	1·61
May	71,600	39,400	58,700	3·91	4·51
June	78,900	61,300	68,700	4·58	5·11
July	85,600	76,100	81,200	5·41	6·24
Aug.	86,100	75,500	81,200	5·41	6·24
Sept.	74,900	25,100	49,200	3·28	3·66
Oct.	28,000	16,800	20,300	1·35	1·56
Nov.	21,900	14,900	19,000	1·27	1·42
Dec.	14,900	10,700	12,900	0·86	0·99
Year	86,100	7,450	36,490	2·43	33·20

29—COLUMBIA RIVER—near Revelstoke

Drainage area, 9,000 square miles

DESCRIPTION OF GAUGING STATION

Location—SE¼, sec. 33, tp. 23, rge. 2, W. 6th mer., above the mouth of Illecillewaet river, on downstream side of highway bridge near Revelstoke.

Records available—1912 to 1916, during open season.

Gauge—Chain gauge ; read daily during open season.

Channel—About 1,000 feet wide, controlled by an apparently permanent gravel bar, 500 yards below. Shift in 1913 apparently caused by the building of a breakwater at the control.

Discharge measurements—Are made from the bridge.

Winter flow—Affected by ice. Frazil ice forms in large quantities.

Accuracy—A and B for open water conditions.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Oct. 12	4,990	2·66	5·45	13,300
1912				
Feb. 27	3,160	1·41	....	4,460[1]
April 19	5,140	2·60	5·54	13,000
June 18	12,500	7·80	15·50	96,900
July 24	15,700	8·60	18·20	135,000
Aug. 20	10,200	6·40	12·75	65,500
Sept. 14	7,570	4·80	9·20	36,400
Oct. 9	6,230	3·10	7·30	19,600
1913				
May 5	5,040	2·40	5·60	12,300
" 26	10,100	6·02	12·82	61,000
June 7	13,400	7·60	16·30	102,000
Sept. 17	7,340	4·33	9·20	31,800

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
June 25	11,500	6·38	13·2	73,600
May 20	8,190	5·93	11·6	48,500
Sept. 7	7,940	4·75	9·5	37,700
Oct. 8	5,750	3·18	7·0	18,300
Nov. 18	4,210	2·66	5·1	11,250
1915				
Jan. 6	4,130	1·82	4·65	7,510[1]
Mar. 17	3,770	1·60	3·70	5,950
May 11	11,000	6·78	13·50	74,700
Nov. 30	4,500	1·84	4·20	8,280
1916				
May 31	8,050	5·10	10·42	41,000
July 19	15,150	8·68	18·50	131,500
Nov. 14	4,450	1·57	5·20	7,010[1]

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.[1]	....	....	....	....	....
Nov.[1]	....	....	....	....	....
Period	....	....	....	....	....
1913					
April	21,800	8,090[2]	12,200	1·36	1·51
May	94,500	12,300	36,500	4·06	4·67
June	148,000	83,600	109,900	12·21	13·62
July	109,000	61,100	84,400	9·38	10·81
Aug.	95,800	47,300	73,000	8·11	9·35
Sept.	71,100	23,400	39,400	4·38	4·89
Oct.	24,000	13,000	17,200	1·91	2·20
Nov.	13,000	9,860	11,200	1·24	1·38
Dec.	....	....	....	....	....
Period	148,000	....	47,975	5·33	48·43
1915					
April	31,300	9,600	19,900	2·21	2·47
May	74,500	29,200	51,900	5·77	6·65
June	84,900	42,800	61,300	6·81	7·60
July	91,500	61,700	77,700	8·63	9·9[illegible]
Aug.	99,000	65,800	85,600	9·51	11·00
Sept.	62,900	15,200	30,300	3·37	3·76
Oct.	20,200	10,800	14,300	1·59	1·83
Nov.	17,700	8,400	11,400	1·27	1·42
Dec.	9,000	7,700	8,050	0·89	1·03
Period	99,000	7,700	40,050	4·45	45·71

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
Mar.	8,800	5,000	7,280	0·81	0·93
April	16,000	8,000	12,000	1·33	1·45
May	65,600	17,000	42,000	4·66	5·36
June	142,000	37,000	87,000	9·66	10·75
July	88,800	71,700	78,700	8·74	10·07
Aug.	104,000	44,200	75,700	8·41	9·70
Sept.	39,250	16,000	27,000	3·00	3·34
Oct.	17,000	12,900	15,795	1·76	2·03
Nov.	12,900	9,700	11,490	1·28	1·43
Period	142,000	5,000	39,660	4·41	45·06
1914					
April	....	....	....	....	....
May	73,500	....	44,500	4·94	5·70
June	132,000	52,700	90,200	10·02	11·17
July	146,000	64,700	103,000	11·44	13·17
Aug.	86,000	42,800	66,700	7·41	8·54
Sept.	46,000	18,200	31,700	3·52	3·93
Oct.	31,300	13,200	19,900	2·21	2·55
Nov.	19,200	11,200	14,300	1·59	1·77
Dec.	12,400	....	8,750	0·97	1·12
Period	146,000	....	47,380	5·26	47·95
1916					
April	21,800	9,700	12,500	1·39	1·55
May	47,200	23,000	34,800	3·87	4·46
June	165,000	42,400	90,800	10·10	11·30
July	156,000	76,400	113,000	12·50	14·40
Aug.	88,700	44,000	69,100	7·68	8·85
Sept.	83,000	21,200	43,000	4·78	5·33
Oct.	34,800	13,700	18,400	2·04	2·35
Nov.[3]	14,200	....	9,180	1·05	1·17
Dec.[3]	....	....	6,000	0·67	0·77
Period	165,000	....	44,100	4·90	50·18

[1] Station established October 12, 1911. Freeze-up November 5, 1911. Channel opened March 1, 1912. Freeze-up occurred middle of December, 1912. [2] Estimated [3] Ice conditions Nov. 12 to Dec. 31; discharge estimated.

30—COLUMBIA RIVER—near Golden

Drainage area, 2,500 square miles

DESCRIPTION OF GAUGING STATION

Location—SW¼, sec. 12, tp. 27, rge. 22, W. 5th mer., above mouth of Kicking Horse river, one mile from Golden, 100 yards below the Columbia River Lumber Co.'s mill.

Records available—During the open season from 1903 to 1915.

Co-operation—Gauge heights from 1903 to 1911 were obtained through the courtesy of the Columbia River Lumber Co.

Gauge—Vertical staff gauge; read daily during the open season. Different gauges have been used.

Channel—The section is situated in the middle of a straight stretch of river of 1,500 feet. At low water, there is a pronounced riffle 300 yards below the gauge, but, at high water, this riffle disappears.

Discharge measurements—Are made from boat held by temporary cable about 100 yards below mill.

Winter flow—Ice conditions generally exist from about the middle of November till the end of March. Frazil ice may be expected.

Accuracy—This station is affected at high stages by backwater from the Kicking Horse river. When the extent of this influence is ascertained it may be necessary to revise some of the data here presented. Any person desiring to use these data for detailed studies should secure the latest revision from the B. C. Hydrometric Survey. Considerable difficulty is also experienced in metering at high stages. The accuracy of the monthly mean discharges for June and July is probably within 20 to 25 per cent and for other months somewhat better.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911				
Oct. 17	792	2·36	10·8	1,870
1912				
Feb. 20	615	1·27	....	795[1]
June 4	1,030	3·02	9·2	3,100
" 8	1,270	3·52	8·1	4,490
" 24	2,485	4·35	5·0	10,800
July 28	1,910	4·60	5·3	8,820
" 28	2,010	4·14	5·6	8,300
Oct. 1	798	2·53	10·5	2,020
1913				
May 23	1,060	3·42	3·7[3]	3,620
June 16	3,710	5·40	2·1	20,000
July 4	2,6[illegible]0	4·26	4·0	11,300
Sept. 16	1,280	4·17	8·1[2]	5,340
Nov. 24	764	2·20	1·8[2]	1,670
1914				
Mar. 2	616	1·45	....	894[1]
July 30	2,540	4·09	7·95	10,400
Oct. 14	855	2·65	2·48	2,260
1915				
Mar. 13	1,420	0·67	0·50	957[1]
May 7	1,940	2·08	3·75	4,050
July 5	2,460	3·73	7·20	9,200
Oct. 25	1,540	1·14	1·58	1,750
1916[4]				
June 6	....	....	5·15	5,280
" 17	....	....	7·10	7,250
" 29	....	....	12·05	19,000
Aug. 17	....	....	7·20	9,270
" 29	....	....	6·70	7,340
Nov. 9	....	....	1·40	1,390

[1] Ice conditions. [2] Different gauge. [3] *Note.*—8 ft. 1 inch on one gauge = 4·48 on other; zero on one gauge (which was marked and recorded in feet and inches) at top, zero on other gauge (feet and tenths) at bottom.
[4] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 352.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
April....	....	....	....	....	....
May....	....	....	....	....	....
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
Nov....	....	....	....	....	....
Period...	....	....	....	....	....
1904					
Mar....	....	....	....	....	....
April....	4,500	1,950	3,000	1·20	1·34
May....	7,000	3,000	4,527	1·81	2·09
June....	11,600	5,500	9,053	3·62	4·04
July....	18,100	9,500	13,164	5·27	6·08
Aug....	9,500	5,200	7,961	3·18	3·67
Sept....	6,000	2,500	4,256	1·70	1·90
Oct....	3,000	1,650	2,077	0·83	0·96
Nov....	1,650	1,625	1,625	0·65	0·73
Period...	18,100	1,625	5,710	2·28	20·81
1906					
April....	3,050	1,575	1,972	0·79	0·88
May....	6,500	3,000	4,468	1·79	2·06
June....	8,300	4,100	5,895	2·36	2·63
July....	13,900	8,500	11,584	4·63	5·34
Aug....	10,800	4,900	7,983	3·19	3·68
Sept....	7,700	2,700	5,048	2·02	2·25
Oct....	3,000	1,860	2,437	0·97	1·12
Nov....	1,950	1,625	1,700	0·68	0·76
Period..	13,900	1,575	5,136	2·05	18·72
1908					
April...	2,800	1,575	2,000	0·80	0·89
May....	7,200	2,450	5,505	2·20	2·54
June....	13,900	6,800	11,320	4·53	5·05
July....	18,500	12,000	14,887	5·95	6·86
Aug....	12,300	5,000	8,438	3·37	3·88
Sept....	5,400	2,350	4,016	1·60	1·78
Oct....	2,350	1,750	1,993	0·79	0·91
Nov....	2,050	1,500	1,600	0·64	0·71
Period...	18,500	1,500	6,220	2·49	22·62
1910					
April....	6,500	1,850	3,000	1·20	1·34
May....	11,300	4,800	7,491	3·00	3·46
June....	13,300	9,900	11,593	4·64	5·18
July....	13,600	11,800	13,000	5·20	6·00
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
Period...	....	....	....	....	....
1903					
April...	2,200	1,650	1,800	0·72	0·80
May...	5,400	2,050	3,174	1·27	1·46
June...	20,800	6,300	15,330	6·13	6·84
July...	15,300	9,500	10,860	4·34	5·00
Aug...	10,600	7,900	9,448	3·78	4·36
Sept...	7,500	2,900	4,933	1·97	2·20
Oct....	6,700	3,000	3,800	1·52	1·75
Nov....	2,900	2,500	2,600	1·04	1·16
Period..	20,800	1,650	6,490	2·60	23·57
1905					
Mar....	1,625	1,200	1,500	0·60	0·69
April...	2,500	1,350	1,593	0·64	0·71
May...	4,800	1,900	3,212	1·28	1·48
June...	10,800	5,200	9,070	3·63	4·05
July...	10,600	7,500	9,558	3·82	4·40
Aug...	10,600	5,000	8,738	3·50	4·04
Sept...	5,200	3,050	4,076	1·63	1·82
Oct....	3,050	1,950	2,000	0·80	0·92
Nov....	....	....	....	....	....
Period..	10,800	1,200	4,970	1·99	18·11
1907					
April...	1,800	1,550	1,600	0·64	0·71
May...	6,800	1,625	4,027	1·61	1·86
June...	12,800	6,700	9,536	3·81	4·25
July...	15,100	11,600	12,767	5·11	5·89
Aug....	12,000	6,700	9,064	3·63	4·18
Sept....	7,500	2,900	5,045	2·02	2·25
Oct....	3,000	2,050	2,513	1·01	1·16
Nov....	2,150	1,625	1,700	0·68	0·76
Period..	15,100	1,550	5,782	2·31	21·06
1909					
April...	1,625	1,450	1,500	0·60	0·67
May...	6,100	1,400	2,423	0·97	1·12
June...	14,800	6,500	11,856	4·74	5·29
July...	16,800	10,600	12,919	5·17	5·96
Aug....	10,600	5,700	7,942	3·18	3·67
Sept....	5,700	2,200	3,933	1·57	1·75
Oct....	3,650	1,800	2,214	0·89	1·03
Nov....	1,800	1,400	1,400	0·56	0·62
Period.	16,800	1,400	5,523	2·21	20·11
1911					
April...	2,300	1,400	1,500	0·60	0·67
May...	4,000	2,050	3,201	1·28	1·48
June...	18,100	4,500	11,793	4·71	5·26
July...	17,100	11,600	12,987	5·19	5·98
Aug....	11,300	5,400	8,019	3·21	3·70
Sept...	6,100	2,150	3,913	1·57	1·75
Oct....	2,150	1,850	1,900	0·76	0·88
Period..	18,100	1,400	6,188	2·48	19·72

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1912					
April....	2,100	1,550	1,750	0·70	0·78
May....	4,800	1,625	3,169	1·27	1·46
June....	11,600	2,700	6,725	2·69	3·00
July....	11,600	8,500	9,594	3·84	4·42
Aug.....	9,100	4,500	7,732	3·09	3·56
Sept.....	4,250	3,200	2,995	1·20	1·34
Oct.....	2,100	1,550	1,900	0·76	0·88
Nov.....	....	....	....	....	....
Period..	11,600	1,550	4,838	1·93	15·44
1914					
April....	3,700	1,900	2,731	1·09	1·22
May....	8,230	3,020	6,014	2·40	2·77
June....	15,800	7,120	11,604	4·64	5·18
July....	19,950	10,020	15,582	6·23	7·19
Aug.....	9,920	5,920	7,991	3·20	3·69
Sept.....	5,840	2,840	4,140	1·66	1·85
Oct.....	3,800	1,920	2,440	0·98	1·13
Nov.....	2,200	....	1,820	0·73	0·81
Period...	19,950	....	6,540	2·62	23·84
1913					
April...	2,000	1,530	1,650	0·66	0·74
May...	9,300	1,600	3,630	1·45	1·67
June...	18,600	9,760	14,400	5·76	6·43
July...	12,600	9,070	11,200	4·46	5·14
Aug....	9,760	6,660	8,300	3·32	3·83
Sept. .	8,840	5,610	6,820	2·73	3·05
Oct....	6,060	2,660	3,875	1·55	1·7[illegible]
Nov....	2,560	1,320	1,870	0·75	0·84
Period.	18,600	1,320	6,468	2·58	23·49
1915					
April..	3,220	1,260	2,070	0·83	0·93
May...	6,290	2,400	4,810	1·93	2·22
June...	8,600	5,280	6,520	2·61	2·91
July...	9,960	8,630	9,490	3·80	4·38
Aug....	10,600	8,630	9,800	3·92	4·52
Sept...	8,470	2,350	4,600	1·88	2·10
Oct....	2,300	1,680	1,910	0·76	0·88
Nov....	....	....	....	....	....
Period.	10,600	1,260	5,613	2·24	17.94

Note.—The mean discharge for the first and last months of the various seasons are, in most cases, partly estimated, gauge readings only being available for portions of the respective months. The actual periods of record for the respective years were: 1903, April 16 to Nov. 23; 1904, April 13 to Nov 24; 1905, Mar. 21 to Oct. 19; 1906, April 1 to Nov. 17; 1907, April 7 to Nov. 26; 1908, April 6 to Nov. 13; 1909, April 8 to Nov. 13; 1910, April 6 to July 20; 1911, April 19 to Oct. 17; 1912, April 6 to Nov. 3; 1913, April 14 to Nov. 30; 1914, April 5 to Nov. 16; 1915, April 1 to Nov. 10.

31—COQUIHALLA RIVER—one mile from mouth

Drainage area, 360 square miles

DESCRIPTION OF GAUGING STATION

Location—Near Hope, in sec. 10, tp. 5, rge. 26, W. 6th mer.

Records available—Continuous records, Nov., 1911, to Dec., 1916.

Gauge—Cable gauge on highway bridge; read two or three times a week. First gauge was destroyed March 23, 1912, when old bridge was demolished. New gauge was established April 10, 1912. Discharge between these two dates estimated. There is also a subsidiary gauge on C.N. Ry. trestle, read four or five times a week.

Channel—Bottom rocky and stream rather shallow; water swift at the higher stages.

Discharge measurements—Are made from downstream side of bridge.

Winter flow—In very cold weather, ice forms along the edges of the stream, with some anchor ice at the riffle which forms the control.

Accuracy—C and D; gauge readings somewhat irregular. Measurements in 1916 showed revision of curve to be necessary.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Nov. 16	146	2·3	1·15 [1]	330
Dec. 12	285	4·3	2·05 [1]	1,220
1912				
Feb. 29	174	2·4	1·25 [1]	422
June 8	597	4·8	3·30 [2]	2,880
" 29	275	3·2	1·90	890
Sept. 13	171	2·0	1·05	334
Nov. 15	276	2·8	1·65	762
" 18	350	3·5	2·25	1,210
" 20	386	3·9	2·45	1,510
1913				
May 12	576	5·7	3·50	3,140
June 21	540	5·8	3·65	3,040
July 21	378	3·7	2·60	1,410
Sept. 9	383	3·7	2·70	1,440
Oct. 13	524	6·0	3·47	3,160
1914				
July 9	299	3·0	1·90	858
" 18	224	2·5	1·60	553
Aug. 28	130	1·4	0·75	178
Oct. 27	188	1·56	0·91	283
Dec. 18	206	1·47	1·68	300 [3]
1915				
June 29	215	2·10	1·30	459
July 10	207	1·77	1·10	367
Dec. 18	230	2·[illegible]	1·25	486
1916				
July 5	48[illegible]	5·[illegible]7	3·40	2,570
" 13	4[illegible]2	4·[illegible]8	3·06	2,100
Aug. 10	280	2·81	1·79	787

[1] Old gauge, now destroyed and section altered. [2] New gauge, established April 10, 1912. [3] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1911					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	3,630	210	1,000	2·78	3·10
Dec.	1,100	470	819	2·27	2·62
Period	....	....	....	....	....
1912					
Jan.	2,090	470	942	2·62	3·02
Feb.	1,270	470	981	2·72	2·93
Mar.	700	230	415	1·15	1·32
April	1,190	740	884	2·46	2·74
May	5,600	1,140	2,662	7·40	8·52
June	2,940	1,010	2,059	5·72	6·37
July	1,500	410	799	2·22	2·56
Aug.	710	310	460	1·28	1·48
Sept.	600	230	365	1·01	1·13
Oct.	1,190	210	471	1·31	1·51
Nov.	2,150	310	1,004	2·80	3·12
Dec.	910	480	587	1·63	1·88
Year	5,600	210	969	2·69	36·58
1913					
Jan.	1,580	320	557	1·55	1·79
Feb.	2,400	250	592	1·64	1·71
Mar.	560	270	391	1·08	1·25
April	2,310	230	1,195	3·32	3·70
May	6,070	890	3,330	9·25	10·66
June	7,040	2,480	3,961	11·00	12·27
July	2,480	850	1,705	4·74	5·46
Aug.	970	330	580	1·61	1·86
Sept.	3,110	320	1,000	2·78	3·10
Oct.	5,690	320	1,665	4·62	5·33
Nov.	2,310	770	1,243	3·45	3·85
Dec.	1,240	470	719	2·00	2·31
Year	7,040	230	1,412	3·92	53·29
1914					
Jan.	7,040	470	1,350	3·75	4·32
Feb.	730	470	560	1·56	1·62
Mar.	3,580	660	1,560	4·34	5·00
April	4,550	1,100	2,850	7·92	8·84
May	5,880	2,570	3,980	11·07	12·75
June	4,160	1,500	2,630	7·31	8·16
July	1,400	350	720	2·00	2·31
Aug.	370	220	279	0·78	0·90
Sept.	930	220	444	1·23	1·37
Oct.	500	270	345	0·96	1·11
Nov.	2,480	810	1,460	4·06	4·53
Dec.	1,200	290	674	1·87	2·16
Year	5,880	220	1,405	3·91	53·07
1915					
Jan.	320	210	252	0·70	0·81
Feb.	300	220	242	0·67	0·70
Mar.	1,550	230	530	1·47	1·70
April	3,200	870	1,580	4·39	4·90
May	1,920	810	1,210	3·36	3·87
June	1,100	430	730	2·03	2·26
July	890	270	406	1·13	1·30
Aug.	270	200	222	0·62	0·72
Sept.	270	180	201	0·56	0·63
Oct.	6,840	180	1,150	3·20	3·69
Nov.	2,310	470	1,010	2·81	3·14
Dec.	1,640	445	697	1·94	2·24
Year	6,840	180	[illegible]	1·91	25·96
1916					
Jan.[1]	....	....	402	1·12	1·29
Feb.	....	....	390	1·08	1·17
Mar.[1]	6,900	....	1,530	4·25	4·90
April	3,170	970	1,580	4·39	4·90
May	4,990	1,500	2,810	7·80	8·99
June	6,200	2,700	3,730	10·40	11·60
July	3,260	1,100	2,020	5·61	6·47
Aug.	1,080	380	634	1·76	2·03
Sept.	600	190	309	0·86	0·96
Oct.	510	150	232	0·64	0·74
Nov.	3,600	170	712	1·98	2·21
Dec.	450	170	244	0·68	0·78
Year	6,900	150	1,220	3·38	46·04

[1] Gauge height-discharge relation affected by ice, and discharge estimated at 390 c.f.s. from Jan. 9 to Mar. 6.

32a—COQUITLAM LAKE

Drainage area, 105 square miles

The following summary has been compiled from records supplied by the British Columbia Electric Railway Co.

AVERAGE RATE OF RUN-OFF FROM COQUITLAM LAKE WATERSHED

Year	1906	1907	1908	1909	1910	1911	1912	1913
Second-feet	1,172	912	1,057	989	987	816	910	809
Second-feet per square mile	11·17	8·67	10·07	9·41	9·40	7·77	8·66	7·70

MEAN MONTHLY RUN-OFF FOR YEAR 1913

Month	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
Sec.-ft.	1,150	818	947	567	696	568	263	229	612	1,050	1,961	847	809
Sec.-ft. per sq. mile	10·94	7·79	9·01	5·39	6·62	5·41	2·50	2·18	5·83	10·00	18·68	8·06	7·70

32b—COQUITLAM RIVER—one mile from mouth

Drainage area, 115 square miles

DESCRIPTION OF GAUGING STATION

Location—In sec. 2, tp. 39, west of the Coast meridian.
Records available—Jan. 25, 1915, to Dec. 31, 1916.
Gauge—Chain gauge on highway bridge at Westminister Junc. ; read daily.
Channel—Gravelly bottom, good control, water dead at low stages.
Discharge measurements—Well define the rating curve.
Winter flow—Affected by ice only in very cold weather, which seldom occurs.
Accuracy—B in 1915 ; C in 1916.
General—The flow as measured at this station is affected by the Coquitlam Lake dam and does not include the water diverted to Buntzen lake for power purposes.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915									
Jan. 25	26	1·53	1·50	40[1]	June 21	25	1·70	1·35	43[3]
April 3	1,170	4·40	5·25	5,160[2]	July 20	6·5	3·70	1·35	20[4]
" 15	792	1·40	3·30	1,120[3]	1916				
					April 14	383	2·61	3·30	998

[1] Section 150 yards below gauge. [2] Section at gauge. [3] Section 100 yards below gauge. [4] Section 120 yards below gauge.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1915						1916					
Jan.	.....	.....	.....	.....	.....	Jan.	60	50	51	0·44	0·51
Feb.	720	70	210	1·82	1·90	Feb.	9,700	50	2,690	23·40	25·20
Mar.	4,3[illegible]0	150	1,100	9·57	11·03	Mar.	7,600	80	2,180	19·00	21·90
April	8,800	150	1,650	14·35	16·01	April	1,850	250	1,070	9·30	10·40
May	720	80	286	2·49	2·87	May	1,850	480	1,070	9·30	10·70
June	250	40	70	0·61	0·68	June[1]	.....	.....	1,520	13·20	14·70
July	40	40	40	0·35	0·40	July[1]	.....	640	1,220	10·60	12·20
Aug.	40	40	40	0·35	0·40	Aug.	560	10	119	1·03	1·19
Sept.	40	40	40	0·35	0·39	Sept.	40	10	14	0·12	0·13
Oct.	3,720	40	377	3·28	3·78	Oct.	350	10	42	0·36	0·42
Nov.	2,300	50	520	4·52	5·04	Nov.	1,400	20	562	4·90	5·47
Dec.	6,740	80	1,550	13·50	15·60	Dec.	.....	.....	.....	.....	.....
Period	8,800	40	535	4·65	58·10	Period	9,700	10	958	8·33	102·82

[1] Gauge out June 18, replaced July 6. Discharge estimated : June 18 to 30, 2,000 sec.-ft.; July 1 to 5, 1,000 sec.-ft.

33—COWICHAN RIVER—near lake outlet

Drainage area, 235 square miles

DESCRIPTION OF GAUGING STATION

Location—Near outlet of Cowichan lake, 500 feet below Canadian Northern Pacific Ry. bridge.
Records available—Mar. 1 to Dec. 31, 1913, by Provincial Water Rights Branch ; Jan. 1, 1914, to Dec. 31, 1916, by British Columbia Hydrometric Survey.
Co-operation—Provincial Water Rights Branch established gauge in 1913.
Gauge—Twelve-foot wooden staff, on downstream side of highway bridge ; read twice daily.
Channel—Gravel and small boulder bed ; straight for 300 feet above and 100 feet below section ; one channel at all stages.
Discharge measurements—Well define rating curve 1913 to 1915. On Feb. 15, 1916, shift in channel occurred, and new rating applies since that date.
Winter flow—Open all winter.
Accuracy—Good ; monthly summaries given below for 1913 and 1914 embody revisions based on later measurements. See NOTE page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec*	*Feet*	*Sec.-feet*
1913				
Jan. 31	1,011	......	3·45	1,377
Sept. 30	743	....	2·00	571
Dec. 10	1,586	....	6·38	3,552
" 20	....	....	5·42	2,944
" 31	1,165	....	4·33	2,950
1914				
June 24	824	0·8	2·08	667 [1]
Aug. 26	533	0·2	0·70	117
" 27	104	1·1	0·72	113 [2]
Nov. 25	1,670	2·6	6·20	4,300
1915				
Mar. 23	1,310	1·60	4·68	2,080
Aug 30	150	0·72	0·61	108 [3]
Dec. 9	1,780	2·71	7·54	4,820
" 9	1,830	2·72	7·71	4,990
1916				
Mar. 22	1,640	2·04	6·60	3,340
" 23	1,620	2·04	6·52	3,310
Nov. 6	952	1·43	3·70	1,360
" 7	955	1·36	3·68	1,300
Dec. 13	1,100	1·38	3·85	1,520

[1] New station established by B. C. Hydrometric Survey. No change in gauge datum. [2] Low water section
[3] Not at regular section.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar	1,740	1,280	1,430	6·08	7·00
April	1,960	1,340	1,650	7·02	7·83
May	1,960	1,460	1,754	7·46	8·60
June	1,810	935	1,260	5·36	5·96
July	935	500	783	3·33	3·83
Aug.	475	230	330	1·40	1·61
Sept	600	230	505	2·15	2·40
Oct.	1,670	500	1,082	4·60	5·30
Nov.	6,400	910	2,552	10·87	12·14
Dec.	6,050	1,810	3,400	14·47	16·67
Period.	6,400	230	1,475	6·28	71·34
1914					
Jan.	7,300	1,880	4,483	19·08	22·00
Feb.	3,130	1,370	1,868	7·94	8·25
Mar.	3,490	2,040	2,908	12·37	14·25
April	2,870	1,880	2,289	9·74	10·87
May	1,810	825	1,243	5·29	6·08
June	825	550	702	2·98	3·32
July	550	230	376	1·60	1·85
Aug.	230	112	168	0·71	0·82
Sept.	350	87	183	0·78	0·87
Oct.	5,500	350	2,378	10·10	11·63
Nov.	4,950	3,220	3,997	16·95	18·94
Dec.	3,490	990	1,951	8·30	9·57
Year.	7,300	87	1,879	8·00	108·45
1915					
Jan.	2,790	1,280	1,930	8·21	9·46
Feb.	1,880	1,340	1,720	7·32	7·62
Mar.	2,360	1,400	1,870	7·96	9·18
April	3,260	1,220	2,340	9·96	11·11
May	1,160	665	842	3·58	4·13
June	655	320	500	2·13	2·38
July	305	170	234	1·00	1·15
Aug.	167	95	132	0·56	0·63
Sept	93	32	54	0·23	0·26
Oct.	3,440	32	616	2·62	3·02
Nov.	3,800	1,980	2,700	11·50	12·80
Dec.	4,980	2,930	3,980	16·94	19·54
Year.	4,980	32	1,410	6·00	81·28
1916					
Jan.	3,010	1,110	1,650	7·03	8·11
Feb.	3,880	1,050	2,340	9·96	10·70
Mar.	4,040	2,290	3,120	13·30	15·30
April	2,690	2,280	2,520	10·70	11·90
May	2,690	1,780	2,260	9·62	11·10
June	1,710	1,360	1,500	6·38	7·12
July	1,310	740	980	4·17	4·81
Aug.	715	334	492	2·10	2·42
Sept.	325	160	230	0·98	1·09
Oct.	433	88	137	0·58	0·67
Nov.	1,510	530	1,190	5·07	5·66
Dec.	1,570	1,140	1,400	3·96	6·87
Year.	4,040	88	1,485	6·32	85·75

34—**CRAZY CREEK**—near mouth

Drainage area, 45 square miles

DESCRIPTION OF GAUGING STATION

Location—Sec. 28, tp. 23, rge. 5, W. 6th mer.

Records available—Mar. 8 to Dec. 13, 1914 ; Mar. 24 to Dec. 31, 1915 ; Apr. 1 to Nov. 12, 1916.

Gauge—Standard, vertical staff gauge, situated on C.P. Ry. siding bridge.

Channel—Channel averages about 75 feet in width ; bed of stream is rocky and velocities are high

Winter flow—Ice conditions exist during November, December, January and February.

Control and diversions—The British Columbia Forest Mills Co. holds records on this stream for 9 sec. ft. The water runs a small hydro-electric plant, consisting of 1 Pelton wheel and 1 C.G.E. dynamo (2,000 volts, 50 amps.) replaced during winter months by steam plant, for purpose of operating saw mill.

Accuracy—Considered good. **The rating curve is well defined.**

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					1915				
Oct. 25	57·8	2·05	1·60	118	July 20	85·5	3·15	2·00	270
1914					1916				
Mar. 3	21·8	1·11	0·72	24	June 14	142	4·61	2·85	656
May 18	124·7	3·00	2·30	371	July 11	109	3·95	2·35	430
July 15	151·2	4·09	2·80	620	Sept. 13	48	2·45	1·48	118
					Oct. 16	34	1·76	1·09	60

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......
1915					
April	415	74	230	5·10	5·69
May	620	205	386	8·58	9·89
June	520	205	306	6·80	7·59
July	540	90	239	5·31	6·12
Aug.	205	32	57	1·27	1·46
Sept.	120	27	40	0·89	0·99
Oct.	160	35	80	1·78	2·05
Nov.	110	29	53	1·18	1·32
Dec.	39	25	29	0·64	0·74
Period	620	25	158	3·51	35·85

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Mar.[1]	53	24	32	0·71	0·63
April	325	29	179	3·98	4·45
May	542	173	356	7·91	9·11
June	722	212	412	9·15	10·22
July	619	82	243	5·40	6·22
Aug.	82	26	43	0·95	1·09
Sept.	189	25	48	1·07	1·19
Oct.	118	43	65	1·44	1·66
Nov.	189	43	78	1·72	1·92
Dec.[2]	67	35	......	......	......
Period	722	24	162	3·60	36·49
1916					
April	400	60	155	3·44	3·84
May	580	145	315	7·00	8·07
June	1,050	315	570	12·66	14·13
July	830	205	410	9·11	10·50
Aug.	190	57	102	2·26	2·61
Sept.	240	53	79	1·75	1·95
Oct.	66	46	55	1·22	1·41
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	1,050	46	241	5·35	42·51

[1]For period Mar. 8 to 31. [2]For period Dec. 1 to 13, after which winter conditions obtained.

35—CRISS CREEK—near mouth

Drainage area, 150 square miles*

DESCRIPTION OF GAUGING STATION

Location—Sec. 22, tp. 22, rge. 22, W. 6th mer. One-half mile from mouth.

Records available—June 14 to Sept. 14, 1912 ; April 22 to Nov. 21, 1913 ; April 1 to Dec. 9, 1914 ; Mar. 22 to Sept. 30, 1915 ; April 1 to Oct. 31, 1916.

Gauge—Standard, vertical staff gauge, 400 yds. above highway bridge ; read daily.

Channel—At measuring section is straight. Velocity is high. Bed gravel and boulders.

Discharge measurements—Are made by wading at low water and from highway bridge at high stages.

Winter flow—Ice conditions exist on this stream during January, February and part of March.

Accuracy—Considered good. The rating curve is well defined and result
10 per cent.

* Officials of the Dominion Forestry Branch state that Criss c[illegible] whoiakun mountain, at a point where government maps show Tranqui[illegible] later surveys, the drainage area of Criss creek will be larger than that here g[illegible]

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912					1914				
June 14	47·6	2·2	1·09	107	May 24	77	5·34	2·05 [1]	412
July 16	31·4	1·2	0·7	38	July 10	29·5	0·83	0·35 [2]	24·5
Aug. 5	28·6	1·15	0·6	33	1915				
" 30	29·2	1·04	0·6	30	April 1	19·2	0·61	0·30	12
1913					" 28	47·9	1·73	1·25	100
April 22	114	1·9	1·62	217	Aug. 26	12·5	0·95	0·22	12
May 17	124	2·03	1·72	251	1916				
June 10	100	1·72	1·49	176	May 12	68·0	2·35	1·47	160
Aug. 15	26·9	1·15	0·53	31	June 15	99·0	3·53	2·04	350
Oct. 4	13·4	0·91	0·18	12	Aug. 18	....	....	0·41	24
					Oct. 13	18·3	0·39	0·14	7

[1] Actual gauge height, 2·10. Gauge sunk 0·5 ft. during previous winter, thus making actual readings 0·05 ft. too high. [2] Actual gauge height, 0·4.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1911						1912				
July....	....	....	....	....	....	July...	334	11	84·2	0·56	0·65
Aug....	....	....	....	....	....	Aug....	52	16	29·7	0·20	0·23
	1913						1914				
April....	....	....	....	....	....	April...	166	18	102	0·68	0·76
May....	444	68	260	1·73	1·99	May...	532	140	328	2·18	2·51
June....	340	76	167	1·11	1·24	June...	310	64	145	0·97	1·08
July....	418	41	169	1·13	1·30	July...	58	13	27	0·18	0·20
Aug.....	85	13	32	0·21	0·24	Aug....	13	6	10	0·07	0·08
Sept....	14	8	12	0·08	0·09	Sept....	21	4	11	0·07	0·08
Oct.[1]....	68	10	31	0·21	0·24	Oct....	17	14	16	0·11	0·12
Nov....	26	20	24	0·16	0·13	Nov....	16	15	15	0·10	0·11
Dec.....	....	....	....	....	....	Dec.[2]...	18	16	....	....	....
Period...	444	8	99	0·66	5·23	Period..	532	4	82	0·55	4·94
	1915						1916				
April....	150	30	89	0·59	0·66	April...	225	28	71	0·47	0·52
May....	1,050	10[illegible]	274	1·82	2·10	May...	510	120	285	1·90	2·19
June....	1,470	24	299	2·00	2·23	June...	730	140	330	2·20	2·45
July....	830	38	242	1·61	1·86	July...	375	44	125	0·83	0·96
Aug.....	500	7	100	0·67	0·77	Aug....	53	3	25	0·16	0·18
Sept.....	25	7	12	0·08	0·09	Sept....	10	2	5	0·04	0·04
Oct.....	....	....	....	....	....	Oct....	8	3	6	0·04	0·05
Period...	1,470	7	169	1·13	7·71	Period..	730	2	121	0·81	6·39

[1] For period Nov. 1 to 21. [2] For period Dec. 1 to 9, after which winter conditions obtained.

36—DEADMAN RIVER—above Criss creek

Drainage area, 300 square miles*

DESCRIPTION OF GAUGING STATION

Location—Sec. 15, tp. 22, rge. 22, W. 6th mer.; above mouth of Criss creek.

Records available—April 22 to Nov. 21, 1913 ; April 1 to Dec. 9, 1914 ; Mar. 22 to Sept 30, 1915 ; April 1 to Oct. 31, 1916.

Gauge—Standard staff gauge ; read daily.

Channel—Gravel and silt. Control apparently changed during 1915 freshet.

Discharge measurements—Are made by wading or from the bridge.

Winter flow—Ice conditions exist during January, February and March.

Accuracy—Is considered good ; results should fall within 5 or 10 per cent.

General—The waters of Deadman river are extensively used for irrigation, and its flow has been measured at a point 3 miles above mouth, also above the Walhachin intake, and in the diversion flume. A dam below Deadman lake, 20 miles from the mouth, stores water for irrigation. For further details of flow see ***Water Resources Papers***. **See also** particulars above respecting flow of Criss creek.

* Revised estimate.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					1915				
April 22	72·8	3·5	3·52	256 [2]	April 1	7	1·0	0·76	7
" 23	91·7	3·1	3·60	281 [1]	" 28	10	1·4	1·10	14
May 17	115·0	4·15	3·95	410 [1]	Aug. 26	21	1·7	1·46	35
June 11	32·9	3·00	2·38	99 [3]	1916				
Aug. 15	19·4	2·53	1·80	49 [4]	May 11	92	3·38	3·49	312
Oct. 6	9·2	1·11	0·93	10 [4]	June 15	67	2·83	2·86	190
1914					Aug. 18	22	2·60	1·74	56
May 24	83	3·36	3·4	278 [1]	Oct. 13	8	2·28	1·00	18
July 10	29·8	1·45	1·6	44					

[1]Measured from bridge. [2] Measured 50 ft. below gauge. [3] Wading 50 ft. above gauge. [4] Wading 20 ft. below gauge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1913						1914		
April....	......	......	......	......	......	April...	267	23	154	0·51	0·57
May....	481	145	261	0·87	1·00	May...	562	135	364	1·20	1·40
June....	156	42	90	0·30	0·33	June...	122	73	96·6	0·32	0·36
July....	133	42	92	0·31	0·36	July...	81	37·5	54·3	0·18	0·21
Aug.....	57	11	31	0·10	0·12	Aug....	66	42·5	54	0·18	0·21
Sept.....	11	10	10	0·03	0·03	Sept....	37·5	11	25	0·08	0·09
Oct.....	12	10	11	0·04	0·05	Oct....	11	9	9·1	0·03	0·03
Nov.....	14	11	12	0·04	0·04	Nov....	13	9	11·1	0·04	0·05
Dec.....	......	......	......	......	......	Dec.[1] ..	9	9	......	......	......
Period...	481	10	72	0·24	1·93	Period..	562·5	9	96·0	0·32	2·92
			1915						1916		
April...	25	3	14·2	0·05	0·05	April...	225	24	85	0·28	0·31
May....	140	11	46·0	0·15	0·17	May...	390	215	270	0·90	1·04
June....	335	56	94·1	0·31	0·35	June...	380	120	225	0·75	0·84
July....	730	85	197·0	0·66	0·76	July...	215	88	150	0·50	0·57
Aug.....	155	25	63·4	0·21	0·24	Aug....	88	45	64	0·21	0·24
Sept.....	30	20	24·8	0·08	0·09	Sept....	78	52	64	0·21	0·23
Oct.....	......	......	......	......	......	Oct....	56	14	24	0·08	0·09
Period.	730	3	73·2	0·24	1·66	Period..	390	14	126	0·42	3·32

[1] For period Dec. 1 to 9, after which winter conditions obtained.

37—EAGLE RIVER—at Malakwa

Drainage area, 350 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Malakwa highway bridge ; sec. 9, tp. 23, rge. 6, W. 6th mer.

Records available—May 14 to Dec. 31, 1913 ; Jan. 8 to Dec. 12, 1914 ; Feb. 7 to Dec. 31, 1915 ; Feb. 16 to Dec. 13, 1916.

Drainage area—Above gauging station, 350 sq. miles ; above mouth, 420 sq. miles.

Gauge—Standard chain gauge, situated on highway bridge ; read daily.

Channel—Uniform and straight for 100 yards above a 1 below the guage

Discharge measurements—Are made from upstream side of highway bridge. Velocities are uniform and not too high.

Winter flow—Partial ice conditions exist on the river during January and February.

Accuracy—Considered to be good, fourteen measurements having been obtained at varying stages, but gauge readings during March, April and May, 1914, are not considered very reliable.

* Revised value based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913				
May 14	674	4·00	4·80	2,690
" 31	1,100	6·46	6·80	7,110
June 7	1,090	6·20	6·70	6,750
July 10	740	4·14	5·12	3,060
Aug. 27	580	2·49	3·70	1,440
Nov. 7	454	1·36	2·61	620
1914				
Mar. 3	206	1·24	1·80	257
May 18	718	3·98	4·90	2,860
July 16	719	4·14	5·05	2,972
1915				
July 20	667	3·10	4·50	2,085
1916				
Feb. 24	387	0·81	2·02	312
June 14	850	4·64	5·95	3,960
July 11	790	4·05	5·43	3,200
Sept. 13	510	1·86	3·27	950

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May [1]	8,150	....	2,860	8·17	9·45
June	12,200	3,370	6,444	18·42	20·58
July	3,950	1,670	2,861	8·17	9·45
Aug.	2,150	1,110	1,739	4·97	5·75
Sept.	3,540	690	1,228	3·51	3·93
Oct.	1,670	480	804	2·30	2·65
Nov.	730	300	519	1·48	1·65
Dec.	480	215	318	0·91	1·05
Period	....	....	....	....	....
1915					
Mar.	880	170	409	1·17	1·35
April	2,680	660	1,721	4·92	5·49
May	4,330	1,750	2,806	8·02	9·23
June	3,670	1,650	2,365	6·76	7·56
July	4,020	1,360	2,200	6·29	7·24
Aug.	2,000	780	1,174	3·36	3·79
Sept.	815	355	530	1·51	1·69
Oct.	1,240	355	696	1·99	2·30
Nov.	950	355	533	1·52	1·70
Dec.	400	200	348	0·99	1·14
Period	4,330	170	1,278	3·65	41·49

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan. [4]	422	320	362	1·03	1·19
Feb. [4]	320	256	268	0·78	0·81
Mar.	445	225	326	0·93	1·07
April	2,285	400	1,559	4·46	5·00
May [2]	4,025	2,050	....	....	....
June	6,800	2,350	4,063	11·61	12·96
July	6,650	1,090	2,632	7·52	8·66
Aug.	1,292	632	896	2·56	2·95
Sept.	2,050	445	769	2·20	2·46
Oct.	1,620	550	849	2·42	2·79
Nov.	1,620	422	785	2·24	2·50
Dec. [3]	605	355	....	....	....
Year [4]	6,800	225	1,332	3·81	....
1916					
Mar.	800	250	510	1·46	1·68
April	2,300	650	1,180	3·38	3·77
May	3,800	980	2,180	6·23	7·18
June	10,000	2,140	4,300	12·29	13·71
July	5,000	1,800	3,070	8·77	10·11
Aug.	1,930	800	1,220	3·49	4·02
Sept.	1,220	520	830	2·37	2·64
Oct.	550	355	430	1·23	1·42
Nov.	500	275	375	1·07	1·19
Dec.	305	225	260	0·74	0·85
Period	10,000	225	1,440	4·12	46·57

[1] May 1 to 13 estimated. [2] For period of 20 days. [3] For period Dec. 1 to 12. [4] Partly estimated. Ice conditions during parts of January and February. Gauge readings for part of May considered unreliable.

38—ELK RIVER—near Elko

Drainage area, 1,450 square miles*

DESCRIPTION OF GAUGING STATION

Location—At the cable station, 50 yards above the highway bridge ¼ mile from Elko, East Kootenay.

Records available—April to Nov., 1914 ; April to Dec., 1915 ; Jan. to Dec., 1916.

Drainage area—Above gauging station, 1,450 sq. miles ; above mouth 1,800 sq. miles.

Gauge—A chain gauge was established at the Elko highway bridge, in November, 1913. When the cable station was established in May, 1914, a new gauge was put in at the section, 50 yards above highway bridge. Readings daily.

Channel—The channel below the highway bridge is confined in a cañon and is permanent, though log jams may occasionally affect the gauge readings. The channel above and below the cable station is straight for approximately 40 yards. There is a distinct riffle 30 yards below the section at low water, but, at high water, it is drowned by the water backed up by the narrow cañon below. The low water control below the cable station may shift somewhat in high water.

Discharge measurements—Are made from the cable station. The section is ideal at all stages, except extreme high water, when it is impossible to obtain accurate soundings.

* Revised value based on recent measurements.

Winter flow—Partial ice conditions exist and frazil ice may be expected.

Accuracy—The measurements should be very reliable. Before July, 1914, the chain gauge caused trouble. The rating curve appears to be good. The results after July, 1914, should be within 5 per cent ; before that date, within 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
Nov. 11	300	4·42	3·20	1,330
1914				
June 5	1,410	7·73	4·55	11,000
" 17	1,140	7·47	3·60	8,570
" 19	1,200	7·42	3·80	8,950
July 30	515	3·48	4·80	1,790
" 26	536	3·51	4·20	1,880
Oct. 7	455	2·95	3·55	1,360
" 14	458	3·07	3·60	1,410
Dec. 18	281	2·24	2·80	630 [1]
1915				
Feb. 23	348	1·73	4·40	601 [1]
April 24	672	4·17	4·90	2,800
May 13	838	5·96	2·40	5,000
" 31	755	5·24	2·00	3,940
June 15	724	4·89	1·80	3,620
Aug. 28	482	3·03	0·55	1,460
1916				
Mar. 1	242	2·23	....	546 [1]
July 29	763	4·35	5·12	3,320
Aug. 21	438	4·97	4·44	2,180
" 19	674	3·45	4·65	2,327
Sept. 11	614	3·21	4·25	1,970
" 14	568	3·00	3·93	1,720
Oct. 6	443	2·30	2·25	1,010

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1915					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April [2]	4,080	1,060	2,220	1·53	1·71
May	6,560	2,920	4,260	2·94	3·39
June	8,800	3,030	4,780	3·30	3·68
July	6,420	2,510	3,490	2·41	2·78
Aug.	2,510	1,380	1,740	1·20	1·38
Sept.	1,340	1,200	1,260	0·87	0·97
Oct.	1,310	1,200	1,260	0·87	1·00
Nov.	1,310	1,020	1,170	0·81	0·90
Dec.	1,230	980	1,070	0·74	0·85
Period	8,800	980	2,360	1·63	16·66
1914					
April	3,240	930	1,950	1·34	1·50
May	8,290	3,380	5,820	4·01	4·61
June	11,300	3,460	6,230	4·30	4·99
July	4,560	1,720	3,030	2·10	2·43
Aug.	1,720	1,220	1,470	1·01	1·16
Sept.	1,600	1,120	1,260	0·87	0·97
Oct.	2,060	1,330	1,500	1·03	1·19
Nov.	2,660	1,270	1,660	1·14	1·27
Dec. [1]	1,220	....	850	0·58	0·68
Period	11,300	....	2,640	1·82	18·80
1916					
Jan.	....	....	920	0·63	0·73
Feb.	....	....	680	0·47	0·51
Mar.	....	....	950	0·65	0·75
April	3,520	1,480	1,930	1·37	1·53
May	8,200	2,880	4,330	2·99	3·45
June	22,600	4,200	11,500	7·93	8·85
July	14,200	2,880	7,640	5·27	6·08
Aug.	2,880	1,860	2,300	1·59	1·83
Sept.	2,730	1,280	1,710	1·18	1·32
Oct.	1,280	1,140	1,190	0·81	0·93
Nov.	1,330	1,040	1,160	0·80	0·89
Dec.	....	....	1,090	0·75	0·86
Year	22,600	....	2,950	2·04	27·73

[1] Partly estimated. [2] Gauge readings were taken during Jan. to Mar., but ice conditions did not permit estimates of discharge to be made until March 18.

39—ENGLISHMAN RIVER—near mouth

Drainage area, 111 square miles*

DESCRIPTION OF GAUGING STATION

Location—¼ mile from mouth ; 1,000 feet upstream from Island highway bridge ; 2 miles from Parksville.

Records available—Broken records Feb. 15 to Dec. 31, 1913, by Provincial Water Rights Branch ; May 19 to Sept. 21, 1914, and Dec. 9, 1914, to Dec. 31, 1916, by B. C. Hydrometric Survey.

Co-operation—Provincial Water Rights Branch established station in 1913.

Gauge—12 feet of enamel staff, in two six-foot lengths, situated on right bank, 100 feet upstream from measuring section ; read daily.

* Estimate by B. C. Hydrometric Survey.

Channel—Even gravel bed ; channel straight for 500 feet above and below section ; one channel at all stages ; liable to shift each year.

Discharge measurements—Cable carrier used at high stages.

Winter flow—Open all winter.

Accuracy—Fair ; monthly summaries given below for 1913 and 1914 embody revisions based on later measurements. See NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913[8]					Aug. 29	110	0·2	1·47	19·9
Feb. 15	153	....	1·48	315 [1]	Dec. 10	227	1·2	2·50	266
Aug. 9	50	....	2·21	51·5 [1]	1915				
Dec. 13	446	....	2·21	1,082 [2]	April 14	279	2·02	3·00	563
" 17	377	....	1·85	758 [2]	Sept. 3	24	0·45	1·60	10·7 [6]
1914					Nov. 2	453	2·18	3·50	986 [6]
May 19	160	1·9	2·50	304 [3]	1916				
July 9	156	0·8	2·00	127 [4]	Mar. 18	440	1·47	3·18	657
Aug. 29	14	1·5	1·47	21 [5]	Oct. 28	17	0·95	1·58	16·3 [7]

[1] Metered near Major Greig's ranch. [2] Metered at Island Highway bridge. [3] New station established by B. C. Hydrometric Survey. Gauge datum lowered 1·4 ft. [4] Cable carrier installed. [5] Low water section. [6] Not at regular section. [7] Wading measurement, new cable carrier installed.
[8] Discharge measurements in 1913 were made by Provincial Water Rights Branch.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1913						1914		
Feb.[1]....	2,660	290	747	6·73	2·75	Feb....	....	....	....	....	....
Mar.....	500	183	271	2·44	2·81	Mar....	....	....	....	....	....
April[2]...	980	210	373	3·36	2·38	April...	....	....	....	....	....
May[3]...	800	195	420	3·78	4·08	May[6]..	500	180	330	2·98	1·44
June....	470	250	327	2·94	3·28	June...	340	210	256	2·31	2·58
July....	415	65	192	1·73	2·00	July...	210	30	85	0·77	0·89
Aug.....	65	15	35	0·31	0·36	Aug....	30	5	22	0·20	0·23
Sept.[4]...	440	10	101	0·91	[illegible]	Sept.[7]..	640	3	63	0·57	0·43
Oct.....	1,785	78	280	[illegible]	[illegible]	Oct....	....	....	....	....	....
Nov.[5]...	640	90	197	[illegible]	0·40	Nov....	....	....	....	....	....
Dec.....	....	....	....	....	....	Dec.[8]..	340	135	195	1·76	1·37
			1915						1916		
Jan.....	3,020	165	613	5·53	6·38	Jan....	390	150	190	1·73	1·99
Feb.....	1,350	390	609	5·49	5·72	Feb....	3,680	180	1,040	9·45	10·20
Mar.....	2,600	250	656	5·91	6·81	Mar....	3,440	340	1,160	10·50	12·10
April....	2,840	165	604	5·44	6·07	April...	1,290	560	767	6·97	7·78
May.....	365	150	230	2·07	2·39	May...	1,400	390	737	6·70	7·72
June....	165	65	107	0·96	1·07	June...	1,180	415	611	5·55	6·19
July....	65	30	44	0·40	0·46	July...	560	165	322	2·93	3·38
Aug.....	30	25	28	0·25	0·29	Aug....	180	65	107	0·97	1·12
Sept.[9]...	25	23	24	0·22	0·25	Sept....	65	30	41	0·37	0·41
Oct.....	2,840	25	618	5·57	6·42	Oct....	1,130	15	77	0·70	0·81
Nov.....	1,640	170	644	5·80	6·47	Nov....	1,290	114	368	3·35	3·74
Dec.....	2,960	390	1,220	11·00	12·70	Dec....	1,880	114	355	3·23	3·72
Year....	3,020	23	450	4·05	55·03	Year...	3,680	15	481	4·37	59·16

[1] For period Feb. 15 to 26. [2] April 1 to 19. [3] May 3 to 31. [4] Sept. 1 to 7 and 21 to 30. [5] Nov. 1 to 6. [6] May 19 to 31. [7] Sept. 1 to 21. [8] Dec. 9 to 31. [9] Partly estimated.

40—FALLS CREEK—near mouth

Drainage area, 89 square miles

DESCRIPTION OF GAUGING STATION

Location—Near mouth of Falls creek, tributary of Ecstall river, 18 miles above its confluence with the Skeena.

Records available—Mar. 1, 1912, to Feb. 28, 1913.

Drainage area—89 sq. miles from triangulation survey. The drainage area includes 12 fair-sized glaciers, and numerous snowfields.

General—The following summary has been compiled from records taken and supplied by Messrs. Ritchie, Agnew & Co., engineers, Prince Rupert. This firm in 1911, 1912 and 1913 made a careful study of the power possibilities of Falls creek and Khatada river, with a view to their future development for power supply to Prince Rupert.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Mean	Discharge in second-feet: Per sq. mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Mean	Discharge in second-feet: Per sq. mile	Run-off depth in inches on drainage area
Mar. 1912.......	155	1·74	2·01	Oct. 1912......	1,003	11·30	13·01
April "	441	4·96	5·53	Nov. "	814	9·15	10·21
May "	905	10·18	11·72	Dec. "	768	8·64	9·95
June "	932	10·48	11·70	Jan. 1913......	405	4·56	5·25
July "	1,040	11·70	13·47	Feb. "	362	4·07	4·23
Aug. "	822	9·24	10·64	Year, Mar. 1912 to Feb., 1913..	751	8·44	114·67
Sept. "	1,349	15·18	16·95				

41—FINDLAY CREEK—15 miles from mouth

Drainage area, 320 square miles

DESCRIPTION OF GAUGING STATION

Location—At highway bridge, on Findlay Creek road, about 15 miles from mouth and 7 miles from Thunder Hill.

Records available—April 1 to Dec. 31, 1914; April 1 to Dec. 31, 1915. Station discontinued.

Co-operation—This station was maintained by co-operation between the B. C. Hydrometric Survey and the Provincial Water Rights Branch.

Gauge—Vertical staff gauge, near Mason's cabin, about 1½ miles below measuring section; read daily.

Channel—Rocky above and below section; not liable to shift.

Discharge measurements—Are made from the highway bridge.

Winter flow—Winters severe; frazil ice.

Accuracy—D, probably within 20 per cent.

General—Up to the present this creek has been used for lumbering and placer mining.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913					Aug. 1	184	5·77	2·70	1,060
Oct. 24	104	2·81	0·80	294	Sept. 23	107	2·90	1·00	314
1914					Oct. 20	105	3·11	0·90	327
April 13	84	2·56	0·72	211	1915				
June 18	374	10·52	6·20	3,940	Sept. 25	89	3·17	0·90	282

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914						1915					
April....	860	288	461	1·44	1·61	April...	....	....	....	....	....
May....	1,770	500	1,030	3·22	3·71	May...	1,180	540	766	2·39	2·67
June....	3,950	1,120	2,000	6·25	6·97	June...	1,640	710	1,110	3·47	3·87
July....	3,360	910	1,820	5·68	6·55	July...	1,640	710	1,120	3·50	4·03
Aug.[1]...	1,120	400	688	2·15	2·48	Aug....	1,180	620	811	2·54	2·98
Sept.[1]...	710	288	392	1·23	1·37	Sept....	540	288	363	1·13	1·26
Oct.....	325	270	303	0·95	1·10	Oct....	325	270	290	0·91	1·05
Nov.....	325	252	275	0·86	0·96	Nov....	288	238	253	0·79	0·88
Dec.....	252	....	245	0·77	0·89	Dec....	252	238	245	0·77	0·89
Period...	3,950	....	802	2·51	25·64	Period.	1,640	238	795	2·48	17·58

[1] Partly estimated.

42—FRASER RIVER—at Chilliwack* Drainage area, 88,300 square miles

DESCRIPTION OF GAUGING STATION

Location—On front wharf at Chilliwack.

Records available—Gauge heights only, Feb., 1906, to Dec., 1915.

Co-operation—These records were taken by the Department of Public Works, Canada, New Westminster office.

Gauge—Staff gauge ; read about 10 a.m. daily, with occasional exceptions on Sundays. It is believed that there has been no change in zero elevation since gauge records have been kept. Due to silt, however, it is not possible to read the gauge at extreme low stages.

Datum—Zero is 21·96 ft. below deck of wharf and 22·56 ft. above Sandheads zero.†

Bench marks—Concrete pillar at S.W. corner of shed, close to side, iron pipe in centre. Elevation 41·82 feet in reference to Sandheads zero and 19·26 feet above gauge zero

Discharge measurements—None have yet been made at this station.

Remarks—Subject to tidal influence to small extent, about a maximum of 6 inches at low water in winter.

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915[1]

1906

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1	....	3 0	1 3	1 3	7 6	11 3	10 6	10 3	6 9	8 0	7 3	3 6
2	....	2 9	1 3	1 9	7 9	11 3	10 9	10 3	6 9	7 9	7 0	3 3
3	....	3 0	1 0	2 3	8 0	11 3	11 0	10 0	6 9	8 0	6 9	3 3
4	....	2 9	1 0	2 0	8 3	11 6	11 0	10 0	6 9	7 9	6 6	3 3
5	....	2 9	1 0	2 6	8 6	11 6	11 3	9 9	6 9	7 3	6 9	3 3
6	....	2 6	1 0	3 0	9 0	11 6	11 3	9 3	7 3	7 0	6 6	3 3
7	....	2 3	1 0	3 3	9 0	11 6	11 9	8 9	8 9	7 0	6 6	3 6
8	....	2 0	1 3	3 6	8 9	11 9	12 0	8 6	9 6	7 3	6 3	3 0
9	....	2 0	1 3	3 9	8 6	11 9	12 3	8 6	10 6	8 0	6 3	2 9
10	....	1 9	1 3	4 3	8 6	11 6	12 6	8 6	10 3	9 3	7 0	2 3
11	....	1 9	1 0	4 6	8 6	11 0	12 6	8 6	10 6	9 3	6 9	2 3
12	....	1 9	0 9	4 9	8 6	11 0	12 6	8 6	10 6	9 0	6 9	2 0
13	....	1 6	0 6	4 6	8 6	11 0	12 6	8 9	10 6	8 6	8 0	2 0
14	....	1 6	0 6	4 3	8 9	10 9	12 6	8 9	9 9	8 3	9 9	1 9
15	....	1 3	0 6	4 0	9 0	10 6	12 6	9 0	8 9	8 3	8 3	2 0
16	....	1 3	0 9	4 0	9 6	10 6	12 3	9 0	8 0	9 0	7 6	2 0
17	....	1 3	0 9	4 0	9 9	10 6	12 3	9 0	7 6	10 0	7 0	2 0
18	....	1 6	0 6	4 0	10 0	10 6	12 6	8 9	7 0	9 9	6 6	2 9
19	....	2 3	0 6	4 3	10 0	10 3	12 3	8 6	6 9	9 0	6 0	3 0
20	....	2 0	0 6	5 0	10 3	10 3	12 3	8 0	7 3	8 6	6 0	3 0
21	....	2 0	0 3	5 3	10 3	10 0	12 3	7 6	8 0	8 3	5 6	2 9
22	....	1 9	0 3	5 9	10 0	10 0	11 9	7 0	8 3	8 0	5 3	3 0
23	....	1 9	0 3	6 0	10 3	9 9	11 6	6 9	8 6	7 6	5 0	3 6
24	....	1 6	0 3	6 0	10 6	9 6	11 3	6 9	8 6	7 3	4 6	3 3
25	....	1 6	0 3	6 3	10 6	9 9	11 3	6 3	8 3	9 9	4 6	3 0
26	....	1 6	0 3	6 6	10 9	9 9	11 0	6 3	7 9	10 0	4 3	3 0
27	....	1 6	0 3	7 0	11 0	9 9	11 0	6 3	7 6	8 6	4 3	2 6
28	....	1 6	0 6	7 3	11 0	10 0	11 0	6 3	7 6	8 6	4 0	2 6
29	....	....	0 6	7 3	11 0	10 3	10 9	6 3	7 6	8 3	3 9	2 6
30	....	....	0 9	7 3	11 0	10 6	10 6	6 9	7 6	7 9	3 9	2 6
31	....	....	1 3	....	11 3	....	10 6	6 9	....	7 6	....	2 3

[1] As will be observed from the tables, the Chilliwack records are given to the nearest 3 inches on the gauge from 1906 to June, 1912, and subsequently to the nearest inch.

* Gauge height records in connection with navigation requirements have been made by the Department of Public Works, Canada, on the Fraser river at Mission and Sumas as follows :

MISSION—

Location—Pier of C.P.Ry. bridge.

Records available—Months of May, June and July, 1895, to date.

Gauge—Board.

Datum—Zero elevation is 9·23 ft. above Sandheads zero.†

Bench marks—Base of rail, C.P.Ry. Mission bridge, 44 ft. above Sandheads zero.

Remarks—Subject to tidal influence to the extent of 3 ft. in winter.

SUMAS—

Location—At mouth of small slough near Miller landing.

Records available—1892 to date; gauge does not read below 13-14 ft ; extreme low water is about 12 ft.

Gauge—Automatic ; installed in 1892.

Datum—Zero elevation is same as Sandheads.†

Bench marks—Concrete B.M. erected near gauge. Elevation 38·95 ft.

Remarks—Subject to tidal influence ; the daily range varies from zero at high water with neap tides to about 2 ft. at low water with spring tides.

† Sandheads zero is the extreme low water in the gulf of Georgia as indicated by the zero of the tide gauge at Garry point.

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915—*Continued*

1907

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1	2 0	1 3	2 0	1 0	4 6	15 6	15 6	10 9	8 0	5 3	3 6	4 0
2	1 9	1 6	2 0	0 9	4 9	15 6	15 6	10 9	8 9	5 3	3 6	3 9
3	1 6	1 6	2 0	0 9	5 0	15 9	15 3	10 6	8 6	5 3	3 6	3 6
4	1 6	1 6	1 9	1 0	5 6	15 9	15 3	10 6	8 0	5 3	3 6	3 6
5	1 6	1 6	1 9	1 0	5 9	15 9	15 0	10 6	7 9	5 0	3 6	3 6
6	1 6	1 6	1 6	1 0	6 3	15 6	14 9	10 6	7 6	5 0	3 9	3 6
7	1 6	1 9	1 6	1 0	6 9	15 3	14 6	10 3	7 3	5 0	3 9	3 3
8	7 3[1]	2 6	1 6	1 3	7 6	15 0	14 3	10 3	7 3	5 3	3 6	3 3
9	7 0	2 9	1 6	2 0	8 0	15 3	14 0	10 0	7 3	6 3	3 6	3 3
10	7 6	2 3	1 6	3 6	9 0	15 3	13 9	9 6	7 3	6 0	3 6	3 0
11	7 3	2 3	1 3	2 6	9 6	15 3	13 6	9 0	7 3	5 9	3 6	3 0
12	7 3	2 0	1 3	2 3	9 9	15 0	13 3	8 6	7 0	5 3	3 6	3 0
13	7 0	1 9	1 3	2 3	10 0	14 6	13 0	8 3	6 9	5 0	3 6	3 0
14	7 0	1 6	1 3	2 6	10 6	14 0	13 0	8 3	6 6	4 9	3 3	2 9
15	7 0	1 6	1 3	2 6	10 9	13 9	12 9	8 0	6 6	4 6	3 0	2 6
16	7 0	1 6	1 3	2 9	11 6	13 9	12 6	8 0	6 3	4 6	3 0	2 3
17	6 6	1 6	1 3	3 0	11 9	14 6	12 3	8 0	6 0	4 3	3 0	2 3
18	6 0	1 6	1 3	3 3	12 0	15 0	12 0	8 3	6 0	4 3	3 0	2 3
19	5 6	1 9	1 0	3 0	12 3	15 3	11 9	8 6	5 9	4 0	3 0	2 0
20	5 6	1 6	1 0	3 3	12 6	15 0	11 6	8 6	6 0	4 0	3 0	2 0
21	5 6	1 6	1 0	4 0	12 6	15 0	11 6	8 9	5 9	3 9	3 3	2 0
22	5 6	1 6	1 0	4 3	12 9	14 9	11 6	8 6	5 9	3 9	3 6	2 0
23	5 6	1 6	1 0	4 6	13 0	14 9	11 6	8 6	6 0	3 6	3 3	2 0
24	4 6	1 9	1 0	4 9	13 0	14 6	11 6	8 3	6 0	3 6	3 3	2 0
25	3 9	2 0	0 9	4 9	13 0	14 6	11 6	8 0	5 9	3 6	3 3	2 0
26	2 9	2 0	0 9	4 9	13 0	14 6	11 3	8 6	5 9	3 6	3 6	2 0
27	2 0	2 0	0 9	4 9	13 0	14 6	11 0	8 9	5 9	3 6	3 3	2 0
28	1 9	1 9	0 9	4 9	13 3	14 9	11 0	8 6	5 9	3 6	3 3	2 0
29	1 6	......	0 9	4 9	13 9	15 3	11 0	8 3	5 6	3 6	4 6	2 0
30	1 3	......	0 9	4 6	14 0	15 6	10 9	8 3	5 6	3 6	4 3	1 9
31	1 3	......	0 9	......	14 9	......	10 9	8 0	......	3 6	......	1 9

[1] Water level affected by ice jams from Jan. 8 to near end of month.

1908

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1	1 6	1 0	1 0	1 0	5 3	13 0	15 3	11 3	8 0	5 0	3 9	5 0
2	1 6	Dry[2]	1 0	1 0	5 9	13 0	15 3	10 9	7 3	6 6	4 9	4 6
3	1 6	"	1 0	1 0	6 0	13 0	15 6	10 6	7 3	7 0	5 9	4 0
4	1 6	"	1 0	1 0	6 3	12 9	15 9	10 0	7 0	6 9	6 6	3 6
5	1 6	"	1 0	1 0	6 6	13 0	15 9	10 0	6 9	6 9	7 0	3 3
6	1 9	"	1 0	1 0	7 6	13 3	15 9	10 0	6 9	6 6	8 0	3 0
7	1 9	"	1 0	1 0	8 3	13 9	16 3	9 9	7 0	5 9	9 3	2 9
8	1 9	"	1 0	1 0	8 6	14 6	16 3	9 6	7 6	5 6	10 3	2 9
9	1 9	"	1 0	1 0	8 6	15 6	16 0	9 6	7 6	5 3	10 9	2 9
10	1 9	"	1 0	1 0	8 9	16 6	16 0	9 6	7 3	5 3	10 6	2 9
11	1 9	"	1 0	1 0	9 3	17 0	16 0	9 3	6 9	4 9	9 6	2 9
12	1 9	"	1 0	1 0	9 6	17 3	16 3	9 3	6 6	4 9	9 0	3 0
13	1 9	"	1 3	1 0	9 6	17 6	16 9	9 0	6 6	4 9	8 0	3 6
14	1 6	"	1 6	1 0	9 6	17 9	17 0	9 0	6 6	4 6	7 0	3 3
15	1 6	"	1 6	1 0	10 0	17 9	16 9	8 9	6 3	4 6	6 6	3 0
16	1 6	"	1 6	1 0	10 3	17 6	16 6	8 6	6 3	4 3	6 0	2 9
17	1 6	"	1 6	1 3	10 9	17 0	16 3	8 6	[illegible]	4 3	9 9	2 9
18	1 6	"	1 3	2 0	11 3	16 6	16 0	8 3	[illegible] 6	4 0	11 9	2 6
19	1 6	"	1 3	2 6	11 6	16 3	16 0	8 3	[illegible] 6	4 0	10 0	2 6
20	1 6	"	1 3	3 3	11 9	16 0	16 3	8 [illegible]	5 3	4 0	9 6	2 6
21	1 6	1 0	1 3	3 6	12 3	15 6	16 0	8 6	5 0	[illegible] 9	9 6	2 3
22	1 6	1 0	1 3	3 3	12 6	14 9	15 6	8 6	[illegible] 9	3 6	9 0	2 0
23	1 6	1 0	1 3	3 3	12 6	14 3	15 3	8 6	4 [illegible]	3 6	8 6	2 0
24	1 3	1 0	1 6	3 9	12 6	14 6	14 9	8 6	4 9	3 3	8 0	2 0
25	1 3	1 0	1 6	4 0	12 9	14 9	14 6	8 6	4 9	3 3	7 6	2 0
26	1 3	1 0	1 3	4 0	13 0	15 0	14 3	8 3	4 6	3 3	7 0	2 6
27	1 3	1 0	1 3	4 6	13 3	15 0	14 0	8 0	4 3	3 0	6 6	2 9
28	1 3	1 0	1 3	4 9	13 6	15 0	13 6	8 0	4 0	3 0	6 0	2 9
29	1 3	1 0	1 0	4 6	13 6	15 0	13 3	8 3	4 0	3 0	5 9	2 6
30	1 3	......	1 0	4 9	13 3	15 0	12 0	8 3	4 3	4 0	5 3	2 3
31	1 3	......	1 0	......	13 0	......	11 9	8 0	......	4 0	......	2 3

[2] Owing to sand filling at gauge it does not record the lowest water.

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915—Continued

1909

Date	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"
1	2	0	1	9	2	0	2	3	2	3	11	3	11	9	10	0	6	0	5	3	4	6	7	3
2	2	0	1	9	2	0	2	3	2	6	12	3	11	9	10	0	6	6	5	3	5	0	5	6
3	2	0	1	9	2	0	2	0	2	9	12	6	11	9	10	0	6	3	5	3	5	9	4	9
4	1	9	2	0	2	0	2	0	3	3	12	6	12	0	10	0	6	0	6	0	5	3	4	0
5	1	6	2	0	2	0	2	0	3	6	13	0	12	0	9	9	6	0	7	0	4	9	3	9
6	[3]		2	0	2	0	2	0	3	6	13	9	12	0	9	3	6	3	7	0	4	9	3	6
7	"		2	0	2	0	2	0	3	6	13	6	12	0	9	0	6	3	6	9	4	6	3	3
8	"		2	0	Dry[5]		2	0	3	9	13	3	12	3	8	9	6	3	6	6	4	0	2	9
9	"		2	0	"		2	0	3	9	13	0	12	6	8	6	6	3	6	9	3	9	2	6
10	"		Dry[5]		"		2	0	4	0	13	0	12	9	8	3	6	3	7	0	3	9	2	9
11	"		"		"		2	0	4	0	13	6	13	0	8	0	6	6	7	0	3	6	3	0
12	"		"		"		2	0	3	9	14	0	13	0	7	9	6	6	6	9	3	6	4	0
13	"		"		"		2	3	4	0	14	6	13	0	7	9	6	3	7	0	3	3	4	3
14	"		"		"		2	3	4	6	14	9	13	0	7	9	6	9	7	0	3	0	3	9
15	4	0[4]	"		"		2	3	5	0	15	3	12	9	7	9	6	9	6	9	2	9	3	9
16	5	0	"		"		2	3	5	0	15	6	12	6	8	0	6	6	6	6	2	6	3	6
17	6	3	"		"		2	3	5	3	15	6	12	0	8	3	6	3	6	6	2	6	3	6
18	5	9	"		"		2	3	5	3	15	3	11	6	8	0	6	0	6	6	2	6	3	6
19	5	0	"		"		Dry		5	6	15	0	11	0	8	3	6	0	6	6	4	6	3	6
20	3	0	"		"		"		5	3	15	0	10	9	8	3	6	6	6	0	4	3	3	3
21	2	9	"		"		"		5	0	15	0	10	6	8	0	6	3	5	6	3	6	3	3
22	2	9	"		"		"		5	0	15	0	10	6	7	9	5	9	5	3	2	9	3	3
23	2	9	"		"		"		5	0	14	6	10	3	7	3	5	6	5	6	6	0	3	3
24	2	6	"		"		"		5	6	14	3	10	0	7	0	5	6	5	6	6	9	3	3
25	2	6	"		"		"		6	0	13	9	10	0	7	0	5	3	5	3	6	0	3	3
26	2	6	"		"		"		7	0	13	3	9	9	7	6	5	3	5	0	4	6	3	0
27	2	6	"		"		"		7	6	13	0	10	0	7	6	5	0	4	9	3	9	3	0
28	2	3	"		"		2	3	8	0	12	9	10	3	7	0	4	9	4	6	4	0	3	0
29	2	0	....		2	0	2	3	8	9	12	8	10	[illegible]	6	9	4	9	4	6	10	3	3	0
30	1	9	....		2	0	2	8	9	6	12	0	10	3	7	3	5	3	4	6	9	0	3	0
31	1	9	....		2	3	....		10	3	....		10	0	7	0	....		4	6	....		3	0

[3] River frozen at gauge. [4] Levels affected by ice, Jan. 15 to near end of month. [5] Dry at gauge, does not record below 2 feet.

1910

Date	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"
1	Dry		Dry[6]		Dry[6]		3	3	8	6	13	0	10	6	9	3	5	3	3	9	4	9	3	6
2	4	0	"		"		3	3	8	3	12	9	10	6	9	0	5	3	3	9	4	6	3	6
3	3	6	"		"		3	3	8	0	13	0	10	3	8	9	5	3	4	0	4	6	3	3
4	3	0	"		3	0	3	0	8	0	11	9	10	0	8	9	5	3	4	0	4	3	3	3
5	3	0	"		3	0	3	0	8	3	12	0	10	0	8	9	5	3	4	0	4	0	3	3
6	3	0	"		3	0	3	0	8	6	12	6	10	0	8	9	5	3	4	6	4	9	3	3
7	3	0	"		Dry[6]		3	0	9	0	12	3	10	6	8	6	5	3	5	3	5	0	3	3
8	Dry[6]		"		"		3	0	9	9	12	0	10	6	8	6	5	9	5	3	5	6	3	3
9	"		"		"		3	0	10	0	12	3	10	9	8	6	6	0	5	6	4	9	3	3
10	"		"		"		3	0	11	0	12	9	11	0	9	0	5	9	6	0	5	3	3	3
11	"		"		"		3	0	11	9	13	3	11	6	9	0	5	6	5	6	5	9	3	6
12	"		"		"		3	0	11	9	13	6	11	9	9	0	5	3	5	3	5	6	3	6
13	"		"		"		3	0	11	6	13	0	11	9	9	0	5	0	5	3	5	0	3	6
14	"		"		"		3	0	11	3	13	3	12	0	8	9	4	9	5	0	4	6	3	6
15	"		"		"		3	0	10	9	13	8	12	0	8	9	4	9	5	0	4	3	3	6
16	"		"		"		3	0	10	6	14	0	12	0	8	6	4	6	5	3	3	9	3	6
17	"		"		"		3	0	10	3	13	6	11	9	8	0	3	9	5	6	3	9	3	6
18	"		"		"		3	0	10	6	13	0	11	9	7	9	3	6	5	9	3	9	3	6
19	"		"		"		3	3	10	6	12	6	11	6	7	6	3	6	6	0	3	6	3	6
20	"		"		"		4	0	10	3	12	3	11	3	7	6	3	6	7	0	3	9	3	6
21	"		3	0	"		4	3	10	6	12	0	11	3	7	3	3	9	7	3	6	6	3	6
22	3	0	3	3	3	0	4	3	10	9	11	9	11	0	7	3	3	9	7	0	5	9	3	6
23	3	0	Dry[6]		3	0	4	3	11	3	11	9	11	0	7	0	3	9	6	6	5	0	3	9
24	3	0	"		3	3	4	6	11	6	11	9	10	9	7	0	4	0	8	3	4	9	4	0
25	3	0	"		3	3	5	6	12	0	11	9	10	6	6	9	4	0	8	0	4	3	3	9
26	3	0			3	6	6	6	12	3	11	6	10	6	6	6	4	0	6	6	3	9	3	6
27	3	0			4	3	7	6	12	6	11	0	10	6	6	3	4	0	6	0	3	9	3	6
28	3	0			4	9	8	0	12	9	10	9	10	3	6	0	4	0	5	9	3	9	3	6
29	3	0	....		4	3	8	3	13	3	10	6	10	0	5	6	3	9	5	3	3	6	3	6
30	3	0	....		3	9	8	9	13	6	10	6	9	9	5	6	3	9	5	0	3	6	3	6
31	3	3	....		3	3	....		13	3	....		9	6	5	3	....		4	9	....		3	3

[6] Dry at gauge, does not record extreme low water.

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915—*Continued*

1911

Date	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″
1	3	3	3	3	3	3	2	9	4	6	12	3	14	6	12	0	7	0	3	9	2	9	3	3
2	3	3	3	3	3	3	2	9	5	3	13	3	15	0	11	6	7	6	3	9	Dry[1]		3	3
3	3	3	3	3	3	3	2	9	5	9	13	3	15	0	11	0	8	0	3	9	"		3	3
4	3	3	3	3	3	0	2	9	6	6	13	3	15	0	10	9	8	3	3	6	"		3	0
5	3	3	3	3	3	0	2	9	7	6	13	6	15	0	10	9	8	3	3	6	"		3	0
6	3	3	3	3	2	9	2	9	8	0	13	6	15	3	10	6	8	0	3	3	"		3	0
7	3	3	3	3	2	9	2	9	8	6	13	3	15	6	10	6	7	9	3	3	"		3	0
8	3	3	3	3	2	9	2	9	8	9	13	0	15	3	10	3	7	9	3	3	"		3	0
9	3	3	3	3	2	9	2	9	9	0	12	6	14	6	10	0	7	6	3	3	"		3	0
10	3	3	3	3	2	9	2	9	9	0	12	6	14	6	9	9	7	0	3	0	"		3	0
11	3	3	3	0	2	6	2	9	9	0	12	6	15	0	9	6	6	9	3	0	"		3	3
12	3	3	3	0	2	6	2	9	9	0	13	6	14	9	9	3	6	6	3	0	"		3	3
13	3	6	3	0	2	6	2	9	8	9	14	9	14	6	9	0	7	0	3	0	"		3	3
14	3	6	3	0	2	6	2	9	8	9	15	6	14	0	8	9	7	0	3	0	2	9	3	3
15	3	6	3	0	2	6	2	9	8	9	16	0	13	9	8	6	7	6	3	0	2	9	Dry[1]	
16	3	6	3	0	2	6	2	9	9	0	16	9	13	6	8	6	7	0	3	0	2	9	"	
17	3	3	3	0	2	6	2	9	9	3	17	0	13	6	8	3	7	0	3	0	3	0	"	
18	3	3	3	0	2	6	2	9	9	9	17	3	13	6	8	0	7	0	3	0	3	3	"	
19	3	3	3	0	2	6	2	9	10	3	17	3	13	9	7	9	6	9	2	9	3	3	"	
20	3	3	3	0	2	6	2	9	11	0	17	3	13	9	7	9	6	6	2	9	3	0	"	
21	3	3	3	0	2	6	2	9	11	3	16	9	13	9	7	9	6	0	2	9	3	0	"	
22	3	3	3	0	2	6	2	9	11	6	16	0	13	6	8	0	5	9	Dry		3	0	"	
23	3	3	3	0	2	6	2	9	11	3	15	3	13	3	8	0	5	6	"		3	0	"	
24	3	3	3	0	2	6	2	9	11	0	14	3	12	9	8	0	5	0	"		3	0	"	
25	3	3	3	0	2	9	3	0	10	6	14	0	12	6	8	0	4	9	"		3	0	"	
26	3	3	3	0	2	9	3	3	10	3	14	0	12	6	8	0	4	6	"		3	0	"	
27	3	3	3	3	2	9	3	6	10	0	14	6	12	6	7	6	4	3	"		3	0	"	
28	3	3	3	3	2	9	3	6	10	0	14	6	12	6	7	6	4	0	"		3	3	"	
29	3	3	...		2	9	3	9	10	0	14	6	12	6	7	3	4	0	"		3	3	"	
30	3	3	...		2	9	4	0	10	6	14	9	12	6	7	3	3	9	2	9	3	3	"	
31	3	3	...		2	9	...		11	3	...		12	3	7	0	...		2	9	...		"	

[1] Dry at gauge, does not record extreme low water.

1912

Date	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″	′	″
1	Dry		3	6	Dry		Dry		4	9	13	0	13	7	9	0	7	7	3	3	Dry		Dry	
2	"		3	6	"		"		5	0	12	6	13	4	8	11	7	1	3	3	"		"	
3	"		3	6	"		"		5	9	11	9	12	8	8	10	6	10	3	3	"		"	
4	"		3	6	"		"		6	6	11	3	12	0	8	9	6	7	3	3	"		"	
5	"		3	6	"		"		7	0	11	0	11	4	8	10	6	4	3	6	"		"	
6	"		3	6	"		"		7	3	11	0	11	0	9	0	6	2	3	6	"		"	
7	"		3	6	"		"		7	6	10	9	10	11	9	1	6	0	4	0	"		"	
8	"		3	6	"		"		8	0	10	9	10	9	9	0	5	10	4	3	"		"	
9	"		3	6	"		"		8	9	10	6	10	7	9	0	5	7	4	0	"		"	
10	"		3	3	"		"		9	0	10	3	10	6	9	2	5	5	4	0	"		"	
11	"		3	3	"		"		9	0	10	3	10	4	9	2	5	3	3	6	"		"	
12	"		3	3	"		"		9	6	10	9	10	2	9	2	5	2	3	3	3	6	"	
13	"		3	3	"		"		9	9	11	3	10	1	9	2	5	0	3	3	3	9	"	
14	"		3	3	"		"		10	0	11	3	10	1	9	4	5	0	3	3	3	9	"	
15	"		3	3	"		"		10	6	11	9	10	2	9	6	5	0	3	3	3	6	"	
16	"		3	3	"		"		10	6	12	0	10	3	9	6	5	0	3	6	3	6	"	
17	"		3	3	"		"		11	0	12	6	10	5	9	4	4	11	4	0	3	3	"	
18	"		3	3	"		"		11	6	12	9	10	3	9	2	4	9	4	0	3	6	"	
19	"		3	0	"		"		12	3	12	6	10	0	8	10	4	8	3	9	4	0	"	
20	"		3	0	"		"		12	6	12	9	9	11	8	9	4	6	3	6	4	0	"	
21	"		3	0	"		"		12	9	13	3	9	9	9	0	4	6	3	6	4	0	"	
22	"		3	0	"		3	0	12	6	13	9	9	8	9	0	4	4	3	6	4	0	"	
23	"		3	0	"		3	6	12	3	14	3	9	8	9	0	4	4	3	6	4	0	"	
24	"		3	0	"		3	9	12	3	14	6	9	8	9	1	4	2	Dry		3	9	"	
25	"		3	0	"		3	9	12	6	14	9	9	9	9	2	4	0	"		3	6	"	
26	"		3	0	"		4	0	12	9	14	6	9	9	9	5	3	9	"		3	3	"	
27	"		3	0	"		4	3	12	9	14	3	9	7	9	7	3	9	"		Dry		"	
28	"		3	0	"		4	6	13	0	14	3	9	5	9	6	3	6	"		"		"	
29	"		3	0	"		4	9	13	3	14	0	9	3	9	3	3	6	"		"		"	
30	"		...		"		5	0	13	3	13	9	9	3	8	6	3	4	"		"		"	
31	"		...		"		...		13	3	...		9	1	8	0	...		"		...		"	

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915—*Continued*

1913

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1	Dry [1]	Dry	Dry	Dry	4 11	13 9	15 10	11 5	8 7	5 6	4 3	3 9
2	"	"	"	"	4 9	14 5	15 8	11 1	8 3	5 3	4 0	3 6
3	"	"	"	"	4 6	15 3	15 6	10 10	8 1	5 3	4 0	3 6
4	"	"	"	"	4 4	15 8	15 3	10 9	9 0	5 3	3 9	3 3
5	"	"	"	"	4 3	15 7	15 2	10 9	10 0	5 0	3 6	3 3
6	"	"	"	"	4 2	15 5	14 9	10 9	9 2	5 0	3 6	3 0
7	"	"	"	"	4 2	15 5	14 6	10 9	8 1	4 9	3 6	3 0
8	"	"	"	"	4 3	15 6	14 1	10 10	7 11	4 6	3 6	2 9
9	"	"	"	"	5 0	15 6	13 7	10 10	7 11	4 3	3 6	2 9
10	"	"	"	"	5 6	15 7	13 5	10 10	7 11	4 [illegible]	3 3	2 6
11	"	"	"	"	6 0	15 9	13 7	11 0	7 6	5 [illegible]	3 3	2 6
12	"	"	"	"	6 6	16 0	13 6	11 3	7 0	6 0	3 3	Dry [1]
13	"	"	"	"	7 0	16 7	13 2	11 1	6 10	6 9	3 3	"
14	"	"	"	"	8 2	17 0	12 9	10 9	6 10	6 0	3 3	"
15	"	"	"	"	8 9	17 0	12 6	10 7	6 9	5 9	3 3	"
16	"	"	"	"	9 2	16 11	12 2	10 5	6 6	5 9	2 0	"
17	"	"	"	"	9 4	16 8	11 11	10 3	6 8	5 9	3 3	"
18	"	"	"	3 6	9 6	16 4	11 8	10 1	6 8	5 9	3 9	"
19	"	"	"	4 3	9 7	16 0	11 7	10 1	7 0	5 6	3 6	"
20	"	"	"	4 10	9 7	15 9	11 9	9 10	7 6	5 3	3 6	"
21	"	"	"	5 6	9 9	15 4	11 9	9 5	9 0	5 0	3 3	"
22	"	"	"	5 9	10 0	15 0	11 11	9 4	9 3	4 9	3 3	"
23	"	"	"	5 10	10 6	15 2	12 2	9 5	8 6	5 0	3 6	"
24	"	"	"	6 6	10 11	15 7	12 5	9 5	7 6	5 3	3 9	"
25	"	"	"	6 3	11 3	16 1	12 9	9 4	6 11	5 0	4 0	"
26	"	"	"	6 3	11 9	16 4	13 0	9 0	6 4	5 0	4 0	"
27	"	"	"	6 0	12 5	16 4	12 10	9 0	6 0	5 0	3 9	"
28	"	"	"	5 9	12 7	16 2	12 9	9 0	5 9	5 0	3 9	"
29	"	....	"	5 6	12 9	15 11	12 8	9 0	5 9	4 9	3 9	"
30	"	....	"	5 2	13 0	15 10	12 3	8 11	5 6	4 6	3 9	"
31	"	....	"	....	13 3	....	11 9	8 10	....	4 6	....	"

[1] Gauge dry at 2′ 6″

1914

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
1	2 6	Dry	3 3	Dry	7 9	12 3	13 4	10 9	6 0	4 7	5 9	3 9
2	2 6	"	2 9	"	8 3	12 3	13 7	10 0	5 9	4 9	6 0	3 9
3	2 6	"	2 6	"	8 6	12 3	13 11	9 7	5 6	4 9	6 3	3 9
4	2 9	"	Dry	"	9 3	12 2	14 1	9 7	5 3	4 9	6 3	3 6
5	4 4	"	"	"	9 6	12 0	14 4	9 7	5 3	4 6	6 0	2 9
6	5 1	"	"	"	9 9	12 3	14 4	9 5	5 0	4 0	5 10	2 9
7	5 9	"	"	"	9 9	12 6	14 6	9 5	4 11	3 9	5 6	2 9
8	4 6	"	"	"	9 6	12 11	14 3	9 6	4 9	3 6	5 3	2 9
9	4 6	"	"	2 6	9 6	12 9	14 0	9 5	4 8	3 3	5 3	2 9
10	4 6	"	"	2 9	9 9	12 6	13 8	9 2	4 6	3 3	5 3	2 9
11	4 6	"	"	3 0	9 9	12 6	13 6	9 0	4 5	3 0	4 9	2 9
12	4 3	"	"	3 3	10 0	12 8	13 6	8 9	4 5	3 0	4 0	2 9
13	3 9	"	"	4 0	10 9	12 11	13 6	8 6	4 5	3 3	3 9	2 9
14	3 3	"	"	4 9	11 3	13 1	13 6	8 2	4 5	3 6	3 9	Dry
15	3 0	"	"	5 9	11 9	13 3	13 6	8 0	4 3	4 0	3 6	"
16	2 9	"	"	6 0	12 3	13 9	13 7	7 9	4 2	4 9	3 0	"
17	2 9	"	"	6 6	12 6	14 4	13 6	7 9	4 2	5 6	3 0	"
18	2 9	"	"	6 6	12 11	14 9	13 7	7 6	4 2	6 0	2 9	"
19	2 9	"	"	7 3	12 9	15 1	13 8	7 3	4 2	6 3	2 9	"
20	2 9	"	"	7 6	12 9	15 3	13 6	7 6	4 2	6 6	2 9	"
21	2 9	"	"	7 6	12 7	15 3	13 0	7 6	4 2	6 3	2 9	"
22	2 6	"	"	7 6	12 5	15 1	12 4	7 4	4 2	6 0	2 9	"
23	Dry	"	"	7 9	12 6	14 5	12 0	7 3	4 3	6 0	2 9	"
24	"	2 6	"	7 6	12 8	14 0	12 2	7 2	4 3	5 6	2 9	"
25	"	2 9	"	7 3	12 9	13 9	12 6	7 1	4 4	5 0	2 9	"
26	"	2 9	"	7 0	13 0	13 8	12 11	7 0	4 4	4 9	3 0	"
27	"	2 9	"	7 0	13 1	13 5	12 6	6 10	4 4	4 6	3 3	"
28	"	2 9	"	7 0	13 2	13 3	12 3	6 6	4 6	4 3	3 9	"
29	"	....	"	7 2	13 1	13 3	11 11	6 5	4 6	4 6	3 6	"
30	"	....	"	7 2	12 9	13 3	11 8	6 3	4 7	4 9	3 6	"
31	"	....	"	....	12 3	....	11 3	6 2	....	5 3	....	"

DAILY GAUGE HEIGHT OF FRASER RIVER AT CHILLIWACK WHARF, 1906 TO 1915—*Continued*

1915

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "
1	Dry [1]	Dry	Dry	3 6	5 6	10 7	11 2	10 2	8 1	2 7	5 10	Dry
2	"	"	"	3 9	5 6	10 5	11 0	10 2	8 0	2 5	5 6	"
3	"	"	"	3 10	5 5	10 0	11 0	10 2	7 9	2 5	4 9	"
4	"	"	"	3 10	5 7	9 10	10 11	10 1	7 5	Dry [2]	3 10	"
5	"	"	"	3 6	5 9	9 9	10 11	10 0	7 3	"	3 8	"
6	"	"	"	4 0	6 0	9 8	10 11	9 11	7 0	"	3 6	"
7	"	"	"	4 9	6 6	10 0	10 9	9 9	6 9	"	3 3	"
8	"	"	"	6 0	7 3	10 0	10 8	9 6	6 3	"	2 9	"
9	"	"	"	5 9	8 0	9 11	10 7	9 4	5 10	"	2 9	"
10	"	"	"	5 6	8 5	9 10	10 7	9 1	5 5	"	2 6	"
11	"	"	"	5 6	8 9	9 10	10 5	9 0	5 0	"	2 5	"
12	"	"	"	5 6	9 0	9 9	10 3	9 0	4 6	"	Dry	"
13	"	"	"	5 7	9 4	9 8	10 3	8 9	4 4	"	"	"
14	"	"	"	5 5	9 6	9 8	11 3	8 6	4 0	"	"	"
15	"	"	"	5 0	9 7	9 7	11 7	8 4	3 9	"	"	"
16	"	"	"	5 3	9 5	9 6	11 2	8 4	3 6	"	"	"
17	"	"	"	5 10	9 4	9 6	10 11	8 4	3 2	"	"	"
18	"	"	"	6 1	9 3	9 7	10 8	8 4	3 0	"	2·9	"
19	"	"	"	6 4	9 5	9 9	10 7	8 6	3 0	2 7	2·8	"
20	"	"	"	6 7	9 7	10 4	10 6	8 7	3 0	3 0	2·6	"
21	"	"	"	6 6	9 7	10 7	10 5	8 9	3 0	3 3	2·3	"
22	"	"	"	6 4	9 9	10 5	10 4	9 0	3 2	3 4	Dry [3]	"
23	"	"	"	6 3	9 11	10 3	10 4	9 0	3 5	3 2	"	"
24	"	"	"	6 2	10 0	10 2	10 3	9 0	3 6	3 0	"	"
25	"	"	"	6 1	10 3	10 0	10 2	9 0	3 4	3 5	"	"
26	"	"	"	6 0	10 6	9 11	10 2	8 11	3 3	4 0	"	"
27	"	"	"	6 0	10 7	9 9	10 3	8 11	3 3	4 9	"	"
28	"	"	"	6 0	11 0	10 0	10 3	8 8	3 3	6 3	"	"
29	"	......	"	5 10	10 11	10 5	10 2	8 6	3 0	5 6	"	"
30	"	......	"	5 8	10 9	10 9	10 2	8 5	2 9	5 9	"	"
31	"	......	2 9	......	10 8	......	10 2	8 3	......	6 3	......	"

[1] Gauge dry below 2' 9". [2] Gauge dry below 2' 5". [3] Gauge dry below 2' 3".

HIGH WATER ON THE FRASER RIVER

Maximum gauge heights recorded at Mission, Chilliwack and Hope.*

Year	Mission bridge			Chilliwack wharf			Hope		
	Date	Gauge height recorded	Above Sandheads zero †	Date	Gauge height recorded	Above Sandheads zero †	Date	Gauge height recorded	Discharge at Hope
		' "	' "		' "	' "		Feet	Sec.-ft
1876	June 29	22 9	32 0	......	......	......	......	......	......
1882	" 14	23 10	33 1	......	......	......	......	......	......
1894	" 5	25 9	35 0	......	......	......	......	......	......
1895	" 13	19 8	28 11	......	......	......	......	......	......
1896	July 9	21 9	31 0	......	......	......	......	......	......
1897	May 24	18 5	27 8	......	......	......	......	......	......
1898	June 16	18 6	27 9	......	......	......	......	......	......
1899	July 13	19 1	28 4	......	......	......	......	......	......
1900	June 27	21 1	30 4	......	......	......	......	......	......
1901	" 3	19 6	28 9	......	......	......	......	......	......
1902	July 7	17 0	26 3	......	......	......	......	......	......
1903	June 18	22 6	31 9	......	......	......	......	......	......
1904	July 11	18 1	27 4	......	......	......	......	......	......
1905	June 12	16 3	25 6	......	......	......	......	......	......
1906	July 13	13 6	22 9	July 10–15	12 0	35 1	......	......	......
1907	June 4	17 8	26 11	June 3–5	15 9	38 4	......	......	......
1908	" 15	20 0	29 3	" 14–15	17 9	40 4	......	......	......
1909	" 17	18 2	27 5	" 16–17	15 6	38 1	......	......	......
1910	" 16	15 6	24 9	" 16	14 0	36 7	......	......	......
1911	" 19	19 1	28 4	" 18–20	17 3	39 10	......	......	......
1912	" 26	15 11	25 2	" 25	14 9	37 4	......	......	......
1913	" 16	18 10	28 1	" 14–15	17 0	39 7	June 24–25	25·2	262,000
1914	" 21	17 2	26 5	" 20–21	15 3	37 10	" 14–15	30·2	362,000
1915	July 16	11 6	20 9	July 15	11 7	34 2	" 20	27·2	302,000
							" 14	22·3	204,700

* The records at Mission bridge and Chilliwack wharf were supplied by the Department of Public Works, Canada. The records at Hope are by the B. C. Hydrometric Survey.

† Sandheads zero is the extreme low water in the gulf of Georgia, as indicated by the zero of the tide gauge at Garry point.

Note.—The mean of the maximum annual gauge heights recorded at Mission bridge during the 4-year period of the record at Hope is 15' 10"; same for the 10-year period of the record at Chilliwack is 16' 9"; same for the 10-year period, 1894 to 1903, is 20' 4"; same for 22-year period, 1894 to 1915, is 18' 5". It will thus be seen that the *maximum stages* of the Fraser river reached during the last 10 or 12 years have, on an average, not been so high as the stages reached during the preceding decade.

43—FRASER RIVER—at Hope Drainage area, 85,600 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Hope, in sec. 16, tp. 5, rge. 26, W. 6th mer.

Records available—March, 1912, to Dec., 1916.

Co-operation—Gauge read by the engineers of the Kettle Valley railway.

Drainage area—Above station, 85,600 square miles; above mouth, 90,000 square miles.

Gauge—Painted on rock bluff at Kettle Valley Ry. bridge; read daily; also cable gauge on Kettle Valley Ry. bridge, same datum, established Aug. 19, 1916.

Channel—Permanent, with deep water; swift at higher stages.

Discharge measurements—Some made with meter, some by floats. Since completion of railway bridge measurements are more easily made.

Winter flow—Not usually ice enough to affect the gauge height-discharge relations.

Accuracy—The completion of the Kettle Valley bridge has materially improved conditions. Monthly summaries given below for 1912, 1913 and 1914 embody revisions based on later measurements. See NOTE page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912					1914				
Mar. 5	14,405	1·3	10·0	18,300 [1]	July 10	25,300	10·3	24·0	234,000 [4]
June 6	19,835	6·8	21·0	147,000	Aug. 28	18,200	6·2	16·8	101,000 [4]
" 28	26,300	8·5	24·5	225,000 [2]	Oct. 28	16,200	4·4	14·5	72,800 [4]
Sept. 24	12,500	5·9	14·0	73,400 [3]	1915				
Sept. 26	17,200	4·0	14·7	70,000 [3]	Mar. 31	16,800	2·1	12·2	35,200 [5]
1913					July 2	24,490	8·1	21·8	199,000 [5]
June 21	27,100	10·2	26·0	278,000 [4]	Oct. 31	20,000	4·2	15·6	84,100 [5]
					Dec. 17	15,500	1·7	11·2	26,500 [5]

[1] Section at gauge. [2] Measured at Yale. [3] Section above gauge. [4] Float measurement. [5] Kettle Valley bridge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1913					
Jan.	24,600	12,700	18,200	0·21	0·24
Feb.	42,700	19,000	25,000	0·29	0·30
Mar.	26,900	18,300	20,200	0·24	0·28
April	68,800	18,300	34,700	0·41	0·46
May	199,000	32,300	95,300	1·11	1·28
June	362,000	208,000	292,000	3·41	3·81
July	286,000	203,000	229,000	2·68	3·09
Aug.	232,000	190,000	212,000	2·48	2·86
Sept.	197,000	89,000	139,000	1·63	1·82
Oct.	87,400	51,200	62,300	0·73	0·84
Nov.	56,400	26,000	35,700	0·42	0·47
Dec.	26,000	26,000	26,000	0·30	0·35
Year	362,000	12,700	99,117	1·16	15·80

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
Mar.	20,400	14,100	17,100	0·20	0·23
April	73,000	20,400	40,700	0·48	0·54
May	242,000	71,600	176,000	2·06	2·38
June	262,000	174,000	216,000	2·52	2·81
July	224,000	142,000	169,000	1·97	2·27
Aug.	155,000	115,000	140,000	1·64	1·89
Sept.	106,000	52,500	76,400	0·89	0·99
Oct.	71,600	42,700	54,100	0·63	0·73
Nov.	44,900	31,400	37,600	0·44	0·49
Dec.	30,500	23,900	26,800	0·31	0·36
Period	262,000	14,100	95,370	1·11	12·69
1914					
Jan.	71,600	22,500	37,300	0·44	0·51
Feb.	29,600	23,900	27,800	0·32	0·33
Mar.	37,200	28,700	32,000	0·37	0·43
April	111,000	29,600	74,100	0·87	0·97
May	250,000	117,000	202,000	2·36	2·72
June	302,000	214,000	252,000	2·94	3·28
July	262,000	180,000	231,000	2·70	3·11
Aug.	176,000	101,000	131,000	1·53	1·76
Sept.	95,800	64,600	75,700	0·89	0·99
Oct.	76,200	57,700	69,500	0·81	0·93
Nov.	82,600	48,600	62,300	0·73	0·81
Dec.	59,000	27,800	38,100	0·45	0·52
Year	302,000	22,500	102,733	1·20	16·36

* Measurements from latest maps indicate rather less, about 84,500 sq. miles above gauging station.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean.	Per square mile	
			1915		
Jan.	43,800	24,600	31,300	0·37	0·43
Feb.	28,700	21,800	26,500	0·31	0·32
Mar.	41,000	22,200	28,400	0·33	0·38
April	115,000	41,600	88,500	1·03	1·15
May	193,300	97,500	146,[illegible]	1·71	1·97
June	193,300	142,000	162,800	1·90	2·12
July	204,700	158,200	177,300	2·07	2·39
Aug.	168,000	100,900	130,600	1·52	1·75
Sept.	97,500	40,500	59,600	0·70	0·78
Oct.	81,000	32,700	44,900	0·52	0·60
Nov.	73,000	23,200	41,900	0·49	0·55
Dec.	26,900	14,100	20,700	0·24	0·28
Year	204,700	14,100	79,808	0·93	12·72

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
			1916		
Jan.	27,800	12,000	19,200	0·22	0·25
Feb.	41,600	25,300	33,400	0·39	0·42
Mar.	33,200	21,100	27,600	0·32	0·37
April	66,000	22,500	45,100	0·53	0·59
May	176,000	84,200	137,000	1·60	1·84
June	308,000	170,000	232,000	2·71	3·02
July	276,000	172,000	228,000	2·66	3·07
Aug.	168,000	110,000	139,000	1·62	1·87
Sept.	118,000	59,000	83,000	0·97	1·08
Oct.	95,800	42,700	57,100	0·67	0·77
Nov.	56,400	26,900	36,700	0·43	0·48
Dec.	29,600	19,000	22,700	0·26	0·30
Year	308,000	12,000	88,400	1·03	[illegible]·06

44a—FRASER RIVER—at Lytton Drainage area, 63,000 square miles*

DESCRIPTION OF GAUGING STATION

Location—Sec. 1, tp. 15, rge. 27, W. 6th mer., above confluence of Thompson river.

Records available—Feb. 20, 1912, to Dec. 31, 1914.

Drainage area—Above gauging station, 63,000 square miles; above mouth, 90,000 square miles.

Gauge—Gauge painted on rock, and read daily.

Channel—The channel varies in width from 200 feet at low water to 800 feet at high water. The flow is uniform but velocities are very high at high stages.

Discharge measurements—Are taken from ferry boat, but should be accurate except at extreme high water.

Winter flow—Open flow throughout the year

Accuracy—Conditions for gauge readings [illegible]. The rating curve is fairly well defined between discharges of 10,000 sec.-feet [illegible] sec.-feet. Above a discharge of about 70,000 sec.-feet, the gauge-heig[illegible] [illegible] as affected by back-water from the Thompson river, the exact effect of [illegible] determined. Below 10,000 sec.-feet a revision has been made in the [illegible] [illegible]sion chiefly affects discharge estimates for the low water of January, [illegible] 1913, and is embodied in the summaries below. The rating curve used for 1912 [illegible] for the 1913 and 1914 estimates, and the 1912 discharges as here published are [illegible] small at the higher stages. Generally speaking the accuracy of the data given below for this station should be within 5 or 10 per cent. This station is now superseded by a station higher up the river at Lillooet; see next record.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912									
Feb. 20	2,850	4·32	10·0	12,300	July 25	9,180	10·25	23·6	94,000
Mar. 26	2,803	4·11	9·4	11,500	Sept. 29	4,835	7·04	15·0	34,000
May 31	14,600	9·66	32·7	141,000	1913				
June 26	16,100	10·07	34·3	162,000	Sept. 5	7,860	9·53	21·0	74,900

* Measurements from latest maps indicate rather less, about 61,100 square miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
							1912				
Mar.	......	......	......	......	......	Mar.	12,800	9,500	10,360	0·16	0·19
April	......	......	......	......	......	April	51,200	10,800	30,760	0·49	0·55
May	......	......	......	......	......	May	159,250	51,200	99,560	1·58	1·82
June	......	......	......	......	......	June	173,000	80,700	122,200	1·94	2·18
July	......	......	......	......	......	July	133,500	68,500	88,920	1·41	1·62
Aug.	......	......	......	......	......	Aug.	87,000	62,500	78,780	1·25	1·44
Sept.	......	......	......	......	......	Sept.	56,800	32,800	44,610	0·71	0·79
Oct.	......	......	......	......	......	Oct.	51,200	25,500	36,930	0·59	0·68
Nov.	......	......	......	......	......	Nov.	25,500	13,800	21,600	0·34	0·38
Dec.	......	......	......	......	......	Dec.	21,000	12,800	14,950	0·24	0·28
Period	......	......	......	......	......	Period	173,000	9,500	54,870	0·87	9·77
	1913						1914				
Jan.	16,500	5,000	8,910	0·14	0·16	Jan.	23,000	9,500	14,840	0·24	0·28
Feb.	13,000	7,450	9,770	0·15	0·16	Feb.	31,500	9,500	19,040	0·30	0·30
Mar.	13,875	8,200	10,510	0·17	0·19	Mar.	28,500	13,000	18,050	0·29	0·33
April	56,000	9,500	26,450	0·42	0·47	April[1]	14,750	13,000	......	......	......
May	142,500	28,500	79,750	1·27	1·47	May[2]	145,500	14,750	67,670	1·07	1·23
June	182,000	136,250	160,750	2·55	2·84	June	190,400	116,125	148,020	2·35	2·62
July	143,500	99,250	123,310	1·96	2·26	July	165,750	119,800	145,290	2·31	2·66
Aug.	114,875	62,500	86,050	1·37	1·58	Aug.	113,000	66,100	87,590	1·39	1·60
Sept.	99,250	53,000	71,080	1·13	1·26	Sept.	67,300	47,000	56,190	0·89	0·99
Oct.	71,500	44,000	55,500	0·88	1·01	Oct.	55,400	32,100	43,840	0·70	0·81
Nov.	47,000	20,500	30,860	0·49	0·55	Nov.	36,300	23,000	30,100	0·48	0·53
Dec.	28,500	13,000	20,540	0·33	0·38	Dec.	35,100	15,100	22,000	0·35	0·40
Year	182,000	5,000	56,870	0·90	12·33	Year	190,400	9,500	59,330	0·94	11·75

[1] For period April 1 to 4. Gauge reader was drowned early in April, and it was nearly a month before another was secured. [2] Partly estimated.

44b—FRASER RIVER—at Lillooet

Drainage area, 62,500 square miles*

DESCRIPTION OF GAUGING STATION

Location—Pacific Great Eastern Ry. trestle at Lillooet.
Records available—May 14 to Dec. 31, 1915.
Gauge—Cable gauge from the trestle; read twice daily.
Channel—Wide and fairly deep; bed is gravel and boulders. Current is swift at the higher stages.
Discharge measurements—Three taken in 1915 outline the rating curve.
Winter flow—Open water throughout the year.
Accuracy—D, because of insufficient meter measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					1916[1]				
May 15	8,549	10 40	23·30	88,800[2]	May 1	......	......	20·20	53,900
June 26	9,800	11·00	25·50	108,000	June 11	......	......	23·05	84,150
Dec. 6	5,800	3·31	16 02	19,200	" 25	......	......	33·05	215,200
					Sept. 29	......	......	19·00	40,400

[1] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 132. [2] Station established.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
							1915				
June	......	......	......	......	......	June	120,000	91,000	102,000	1·63	1·82
July	......	......	......	......	......	July	145,000	105,000	113,000	1·81	2·09
Aug.	......	......	......	......	......	Aug.	103,000	83,000	91,900	1·47	1·70
Sept.	......	......	......	......	......	Sept.	80,000	41,400	55,100	0·88	0·98
Oct.	......	......	......	......	......	Oct.	55,500	34,200	42,000	0·67	0·77
Nov.	......	......	......	......	......	Nov.	48,800	12,200	27,100	0·43	0 48
Dec.	......	......	......	......	......	Dec.	20,400	10,400	13,700	0·22	0·25
Period	......	......	......	......	......	Period	145,000	10,400	63,543	1·02	8·00

* Measurements from latest maps indicate rather less, about 60,600 sq. miles.

45—GOAT RIVER—near Erickson

Drainage area, 430 square miles*

DESCRIPTION OF GAUGING STATION

Location—Immediately above bridge near Erickson, and 5 miles from mouth.

Records available—May to Nov., 1914 ; Feb. to Nov., 1915.

Gauge—Vertical staff gauge, situated immediately above head of cañon, 20 yards from Cañon siding, on C.P. Ry. ; read daily.

Channel—At the gauge, permanent ; below measuring station, shifting.

Discharge measurements—Are made from the highway bridge below the cañon ¼ mile from Erickson. This section is temporary.

Winter flow—The river generally freezes over for two or three weeks at a time, but seldom for the whole winter. Frazil ice may be expected.

Accuracy—A and B. Rating curve is good and the gauge control is permanent.

General—Goat river drains a mountainous area, but there are said to be no very high peaks or glaciers, consequently the flow is small towards the latter part of the summer.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 8	549	4·55	3·00	2,500
" 28	589	5·00	3·50	2,940
June 18	711	6·02	4·95	4,280
July 21	431	1·7	0·00	735
Aug. 4	367	0·95	−1·10	348
Oct. 18	394	1·26	−0·69	498
Dec. 21	229	1·14	−1·20	261 [1]
1915				
Feb. 19	344	0·49	−1·65	167

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
April 15	534	3·64	2·30	1,950[2]
" 30	565	4·30	4·82	2,430
Nov. 25	367	0·75	0·80	277
1916[3]				
Feb. 25	....	....	Ice	167
June 16	....	....	7·52[4]	5,540
July 24	....	....	3·10	932
Aug. 12	....	....	2·24	382
Sept. 18	....	....	1·86	237
Oct. 10	....	....	1·60	184

[1] Ice conditions. [2] 1915 gauge established with relation to the old gauge. [3] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 351. [4] 1916 gauge to new datum.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May [1]	5,780	2,530	....	....	....
June	5,780	1,730	3,200	7·45	8·32
July	2,310	415	1,170	2·72	3·14
Aug.	400	205	299	0·70	0·81
Sept.	585	205	318	0·74	0·83
Oct.	645	340	440	1·02	1·17
Nov.	1,760	480	938	2·18	2·43
Period	....	....	....	....	....

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1915					
Feb.	272	256	257	0·60	0·62
Mar.	948	256	491	1·14	1·31
April	3,230	855	1,760	4·09	4·56
May	2,700	1,840	2,250	5·23	6·02
June	2,290	948	1,340	3·12	3·48
July	1,180	539	702	1·82	2·10
Aug.	692	240	395	0·92	1·06
Sept.	292	225	254	0·59	0·66
Oct.	432	210	271	0·63	0·73
Nov.	399	225	295	0·69	0·77
Period	3,230	210	810	1·88	21·31

[1] May 7 to 31.

46—GOLD CREEK—near mouth

Drainage area, 350 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge, ½ mile from mouth, opposite Flagstone, East Kootenay.

Records available—May to Aug., 1914 ; April to Sept. 1915 ; April to Oct., 1916.

Co-operation—This station was maintained in 1914 by co-operation between the Provincial Water Rights Branch and the B. C. Hydrometric Survey.

Gauge—Vertical staff, 4 feet long, on downstream side of bridge ; read three times a week.

Channel—Fairly smooth, unbroken, gravel bar below, very liable to shifts.

* Revised value based on recent measurements.

Discharge measurements—Are made from the bridge. They are considered very reliable.

Accuracy—The rating curve is good. Accuracy, during high water, C ; during low water, B. New rating in 1916.

General—Gold creek may be considered an irrigation stream ; it lies on the western side of the Intermontane valley. The mean annual precipitation is light and probably does not exceed 20 inches.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 17	192	5·97	2·35	1,150
June 18	112	3·02	1·35	320
July 11	74	1·65	0·75	123
" 28	48	1·11	0·37	53·8
Sept. 11	30	0·69	0·05	20·6
1915				
April 25	120	2·51	1·22	302
May 14	121	2·76	1·30	335
May 30	108	2·53	1·20	273
June 14	86	1·90	0·90	164
Aug. 27	38	0·92	0·10	34·4
1916				
July 10	142	2·86	2·45	402
" 28	122	1·32	1·92	162
Sept. 12	107	0·70	1·58	74
Oct. 7	58	0·68	1·40	39

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
May	1,210	595	868	2·48	2·86
June	710	175	392	1·12	1·25
July	210	49	107	0·31	0·36
Aug.	60	26	38	0·11	0·13
1915					
April	490	42	262	0·75	0·84
May	397	270	338	0·97	1·12
June	316	72	173	0·49	0·55
July	230	72	126	0·36	0·41
Aug.	72	31	44	0·13	0·15
Sept.	72	31	45	0·13	0·14
Oct.	....	....	....	....	....
Period	490	31	165	0·47	3·21
1916					
April	274	20	100	0·29	0·32
May	544	20	280	0·80	0·92
June	1,700	274	674	1·92	2·14
July	501	132	277	0·79	0·91
Aug.	198	39	104	0·30	0·35
Sept.	58	20	29	0·08	0·09
Oct.	49	30	40	0·11	0·13
Period	1,700	20	215	0·61	4·86

47—GRANBY RIVER (NORTH FORK KETTLE)—near mouth

Drainage area, 950 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Grand Forks, near mouth.

Records available—June 1, 1914, to Dec. 31, 1915.

Gauge—Standard vertical staff gauge, on foot bridge ; read daily.

Channel—Is straight for 100 yards above and below measuring section. Velocity high.

Discharge measurements—Are made by cable suspension from foot bridge

Winter flow—Gauge reader states that only in very severe winters does river freeze over at this point and that it has not done so for past 14 years.

Accuracy—The present results should fall well within 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 19	1,100	4·59	5·08	5,050
June 9	847	2·77	4·00	2,348
July 22	474	0·90	1·48	426
Aug. 22	255	0·35	0·52	88
" 24	244	0·35	0·50	86
1915				
Mar. 19	152	2·51	2·48	382[1]
June 10	733	2·80	3·73	2,040

[1] Backwater from slag.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1914						1915					
Jan.	....	....	....	....	....	Jan.	220	120	174	0.18	0.21
Feb.	....	....	....	....	....	Feb.	300	180	256	0.27	0.28
Mar.	....	....	....	....	....	Mar.	2,200	150	781	0.82	0.94
April	....	....	....	....	....	April	7,790	2,350	3,477	3.66	4.09
May	....	....	....	....	....	May	[illegible],570	2,350	5,666	5.97	6.87
June	13,625	1,780	4,483	4.72	5.26	June	5,880	1,060	2,042	2.15	2.40
July	1,875	220	800	0.84	0.97	July	1,430	870	1,130	1.19	1.37
Aug.	220	70	112	0.12	0.14	Aug.	870	120	426	0.45	0.52
Sept.	340	70	156	0.16	0.18	Sept.	120	85	89	0.09	0.10
Oct.	750	260	431	0.45	0.52	Oct.	100	60	87	0.09	0.10
Nov.	995	485	717	0.75	0.84	Nov.	120	100	114	0.12	0.13
Dec.	435	180	254	0.27	0.31	Dec.	110	100	104	0.11	0.13
Period	13,625	70	993	1.05	8.22	Year	9,570	60	1,196	1.26	17.14

48—GREEN RIVER—at Nairn falls

Drainage area, 180 square miles

DESCRIPTION OF GAUGING STATION

Location—At Nairn falls, 5 miles from the mouth and 3 miles from Pemberton.

Records available—Nov. 20, 1913, to Dec. 31, 1916.

Drainage area—Is not well defined on existing maps, but estimated to be about 180 sq. miles above gauging station.

Gauge—Sloping staff gauge bolted to rocks about 150 yards above falls on left bank; read daily.

Channel—Wide and fairly deep with rock and gravel bottom; a good metering section.

Discharge measurements—Well define the rating curve except at highest stages.

Winter flow—Stream is open all year. Slight ice effect in very cold weather.

Accuracy—Good; monthly summaries given below for 1913 and 1914 embody revisions based on later measurements. See Note, page 309.

General—Gauging stations were established, in November, 1913, at Nairn falls and at Green lake, and, in March, 1914, on tributaries Soo river and Rutherford (Six-mile) creek. The station at the falls gives the unregulated flow at the intake site of the proposed power development, the other three stations show the distribution of this flow, and will be of importance in considering the storage possibilities.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913					Mar. 22	416	4.00	5.10	1,650
Nov. 18	264	3.4	3.80	918 [1]	" 23	458	4.20	5.50	1,920
1914					" 27	261	3.38	3.90	882
June 1	566	4.4	6.50	2,530	April 3	826	6.40	8.80	5,300
July 16	827	5.7	8.75	4,710	" 4	652	5.30	7.30	3,470
Aug. 11	658	4.2	6.60	2,780	" 11	408	3.43	4.80	1,400
Sept. 8	533	3.6	5.88	1,938	" 29	400	3.60	4.95	1,440
Nov. 26	503	4.7	6.20	2,390	May 25	465	4.80	6.10	2,210
Dec. 28	203	1.6	2.60	370 [2]	June 14	603	4.90	6.95	3,000
1915					Aug. 5	596	4.79	6.65	2,830
Jan. 21	185	1.20	0.10	231	1916				
Feb. 6	167	1.41	2.15	238	April 26	367	3.00	4.30	1,100
Mar. 9	202	1.62	2.35	327	May 11	398	3.47	4.70	1,340
" 14	230	1.90	2.68	441	Dec. 6	202	0.97	1.80	197
" 15	354	3.20	4.25	1,140					

[1] Station established. [2] Section probably affected by ice conditions.

NOTE—Rating curve revised 1916, below discharge of 270 cubic feet per second, giving weight to measurement of December 6, 1916.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1913						1914		
Jan.	....	....	....	....	....	Jan.	970	120	276	1·53	1·76
Feb.	....	....	....	....	....	Feb.	260	120	169	0·94	0·98
Mar.	....	....	....	....	....	Mar.	1,710	200	836	4·64	5·33
April	....	....	....	....	....	April	2,290	750	1,843	10·25	11·44
May	....	....	....	....	....	May [2]	2,450	870	1,864	10·37	11·95
June	....	....	....	....	....	June	6,740	[illegible]	3,702	20·58	22·97
July	....	....	....	....	....	July	7,700	2,450	4,810	26·70	30·78
Aug.	....	....	....	....	....	Aug.	3,490	2,450	2,940	16·34	18·84
Sept.	....	....	....	....	....	Sept.[3]	2,450	1,400	1,979	11·00	6·14
Oct.	....	....	....	....	....	Oct.	11,060	500	2,968	16·49	19·02
Nov.[1]	350	230	293	1·63	0·67	Nov.	4,820	830	1,529	8·49	9·47
Dec.	220	120	201	1·12	1·29	Dec.[1]	1,580	350	647	3·59	4·13
Period	....	....	....	....	....	Period	11,060	120	1,075	10·97	142·81
			1915						1916		
Jan.	670	220	361	2·01	2·32	Jan.	320	130	239	1·33	1·53
Feb	350	220	250	1·39	1·45	Feb.	3,090	130	757	4·21	4·54
Mar.	1,920	260	770	4·28	4·93	Mar.	3,390	470	1,090	6·06	6·99
April	6,020	1,120	2,170	12·05	13·45	April	1,930	710	1,320	7·34	8·19
May	4,350	1,120	2,410	13·40	15·45	May	4,130	2,060	2,490	13·90	16·00
June	4,460	1,990	3,240	18·00	20·08	June	6,980	2,810	4,440	24·70	27·60
July	6,260	2,450	4,120	22·90	26·40	July	6,140	2,630	4,080	22·70	26·20
Aug.	5,540	2,450	3,760	20·90	24·10	Aug.	3,910	2,370	3,230	18·00	20·80
Sept.	3,090	970	1,580	8·78	9·80	Sept.	2,900	750	1,490	8·28	9·24
Oct.	4,130	420	1,100	6·11	7·04	Oct.	1,120	470	702	3·90	4·50
Nov.	1,120	350	590	3·27	3·65	Nov.	470	250	306	1·70	1·90
Dec.	470	320	362	2·01	2·32	Dec.	270	150	198	1·10	1·27
Year	6,260	220	1,726	9·59	130·99	Year	6,980	130	1,700	9·44	128·76

[1] For period Nov. 20 to 30. [2] Partly estimated. [3] For period Sept. 1 to 15.

49—ILLECILLEWAET RIVER—near Revelstoke

Drainage area, 480 square miles

DESCRIPTION OF GAUGING STATION

Location—1 mile from the mouth of the river.

Records available—Oct. to Dec., 1911 ; May to Dec., 1912 ; April to Nov., 1913 ; Mar. 1 to Dec. 7, 1914 ; Mar. 1 to Dec. 23, 1915 ; Mar. 23 to Dec. 31, 1916.

Gauge—Chain gauge on upstream side of second highway bridge ; read daily.

Channel—Measuring section is ½ mile below gauge, current at gauge section is very fast in high water, and, at the measuring section, there is a possibility of backwater from the Columbia during highwater. The control changed in 1916.

Diversions—Discharge is partially controlled by the dam and power plant of the city of Revelstoke.

Discharge measurements—Are made from the first traffic bridge

Winter flow—Stream freezes during winter months ; anchor and frazil ice may be expected.

Accuracy—The results should be within 15 per cent. The chain gauge for some time gave trouble to the reader.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1913				
Oct. 13	478	1·40	1·32 [1]	670	Nov. 22	431	1·41	2·35	607
1912					1914				
Feb. 24	221	0·89	0·70 [2]	197	Mar. 17	290	1·64	1·57	478
June 20	890	7·43	6·60	6,610	May 18	704	5·21	4·80	3,670
" 24	962	7·80	6·90	7,510	June 9	661	5·25	4·70	3,450
July 3	735	5·57	5·60	4,100	" 26	820	6·33	5·70	5,190
Aug. 20	583	3·98	4·40	2,320	July 25	763	4·63	4·50	3,540
Sept 14	514	3·40	3·82	1,750	Aug. 11	556	3·71	3·75	2,060 [5]
Oct. 4	498	2·16	3·00	1,080	" 11	658	3·87	3·75	2,500 [6]
1913					Sept 5	506	3·57	3·24	1,800 [7]
May 5	327	3·40	3·00	1,110 [3]	" 5	682	3·04	3·39	2,080 [8]
" 26	636	8·09	6·11	5,030 [3]	Oct. 9	364	2·50	2·38	910
June 11	878	6·92	6·55	6,080	" 9	482	2·16	2·40	1,040 [9]
Sept. 17	660	3·36	3·90	2,220 [4]	Oct. 26	325	2·49	1·95	809

NOTE—See line 14, p. 371, for notes.

DISCHARGE MEASUREMENTS—*Continued*

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					1916				
Oct. 28	400	1·76	1·95	705 [6]	May 30	678	3·98	4·00	2,700 [9]
Nov 17	316	2·27	1·73	715	" 30	582	4·97	4·00	2,890 [10]
1915					July 17	995	6·77	6·50	6,740 [11]
Mar. 17	278	1·28	1·30	358	Aug. 11	763	4·05	3·90	3,090
May 12	630	5·00	4·30	3,150	" 16	777	4·16	4·10	3,220
Oct. 27	407	3·55	2·96	1,440	Sept. 4	858	4·61	4·50	4,000
Dec. 1	198	2·19	1·40	433	Nov. 14	341	1·38	0·64	471 [12]
1916									
Mar. 21	259	1·71	Ice	444 [8]					

[1] Equivalent reading on new gauge about 2·52. [2] New gauge [3] Slightly different section. [4] Different section. [5] At regular measuring section. [6] At gauge section. [7] Measuring section. [8] Ice. [9] Upper highway bridge. [10] Lower highway bridge. [11] New rating after June 19. [12] Ice—corrected gauge height, 0·40.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1911						**1912**					
May						May	7,570	1,040	3,340	6·96	8·01
June	......	......	......	......	......	June [4]	9,060	3,300	5,790	12·08	5·38
July	......	......	......	......	......	July	5,750	3,160	3,810	7·94	9·14
Aug.	......	......	......	......	......	Aug	6,660	1,730	3,490	7·28	8·38
Sept.	......	......	......	......	......	Sept	2,230	810	1,440	3·00	3·35
Oct [2]	890	378	637	1·33	0·94	Oct	1,630	660	950	1·98	2·28
Nov.	630	318	428	0·89	1·03	Nov.	812	610	657	1·37	1·53
Dec [3]	391	300	332	0·69	0·66	Dec.	610	459	524	1·09	1·26
1913						**1914**					
Mar.	......	......	......	......	......	Mar [7]	1,470	......	545	1·13	1·30
April [5]	2,110	300	1,190	2·48	2·32	April	2,280	400	1,550	3·23	3·60
May	6,560	934	2,850	5·94	6·80	May	4,880	2,460	3,790	7·90	9·11
June	11,900	3,740	6,170	12·85	14·28	June	6,900	3,340	5,100	10·62	11·85
July	10,309	3,310	5,140	10·70	12·34	July	7,260	2,820	4,900	10·21	11·76
Aug.	8,970	1,890	3,800	7·92	9·11	Aug.	4,120	1,990	2,770	5·77	6·65
Sept.	11,800	1,240	2,300	4·79	5·36	Sept.	2,340	650	1,350	2·81	3·14
Oct.	1,530	606	1,090	2·28	2·65	Oct.	1,470	520	867	1·80	2·08
Nov. [6]	1,010	606	748	1·56	1·31	Nov	1,010	290	694	1·45	1·62
1915						**1916**					
Mar.	548	215	340	0·71	0·82	Mar.	......	......	......	......	......
April	2,400	548	1,540	3·21	3·57	April	2,220	374	891	1·86	2·08
May	3,980	1,990	2,800	5·83	6·72	May	3,620	1,430	2,240	4·67	5·38
June	4,650	2,460	3,320	6·92	7·72	June	7,660	2,460	4,370	9·10	10·20
July	4,420	2,880	3,660	7·62	8·78	July	6,520	3,230	4,830	10·10	11·60
Aug.	4,960	3,480	4,060	8·46	9·75	Aug	5,110	1,820	3,330	6·94	8·00
Sept.	2,880	734	1,380	2·87	3·20	Sept.	3,780	920	2,040	4·25	4·74
Oct.	1,530	548	919	1·91	2·20	Oct.	2,270	610	805	1·68	1·94
Nov.	1,040	352	574	1·19	1·33	Nov. [8]	610	......	483	1·01	1·13
Dec.	......	......	......	......	......	Dec.	......	......	352	0·73	0·84
Period	4,960	215	2,032	4·30	44·09	Period	7,660	......	2,150	4·48	45·91

[1] On Jan. 2, 1912, gauge and all bench marks were destroyed by bridge gang. The 1911 discharges are computed from 1912 rating curve, the difference in datum between gauges being about 1·2 feet. Section was slightly altered by bridge piers, but not sufficiently to affect materially the gauge height-discharge relationship. [2] Oct. 13 to 31. [3] Dec. 1 to 25. [4] June 19 to 30. [5] April 6 to 30. [6] Nov. 1 to 22. [7] Partly estimated. [8] Estimated Nov. 13 to 28, 460 c.f.s.; Nov. 29 to Dec. 2, 380 c.f.s.; Dec. 3 to 31, 350 c.f.s.

50—INCOMAPPLEUX RIVER—near mouth

Drainage area, 460 square miles

DESCRIPTION OF GAUGING STATION

Location—2 miles from the mouth, immediately outside the Railway Belt, near Beaton, Upper Arrow lake.

Records available—May to Dec., 1914 ; Apr. to Dec., 1915.*

Gauge—Chain gauge situated near Burbridge ranch ; read daily.

Channel—At the gauge the water is swift. The measuring section is satisfactory.

Discharge measurements—Six well-distributed measurements were made in 1914.

Winter flow—Winter conditions not very severe ; frazil ice may be expected.

Accuracy—The measurements should be fairly accurate ; gauge readings are daily but the gauge is not very reliable.

* Gauge readings were obtained in 1913 but, due to considerable trouble with gauges, the records are not considered reliable.

General—This river flows through heavily timbered mountainous country. There are numerous glaciers and extensive snowfields. The river is not navigable but is suitable for logging operations.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913					Sept. 4	752	4·01	4·15	3,020
May 8	635	2·80	2·28	1,800	Oct. 27	564	1·65	2·8	935
" 28	1,130	7·63	4·90	8,632	Nov. 20	490	1·57	2·6	768
July 8	966	6·16	5·50	5,932	1915				
" 18	1,056	5·82	5·02	6,130	Mar. 19	445	0·93	Ice	415
Aug. 11	1,097	5·39	5·60	5,940	May 16	620	3·49	3·90	2,160
Sept. 18	830	4·91	4·87	4,080	Sept. 13	554	1·66	2·85	920
Nov. 21	526	1·13	2·40	597	Oct. 26	555	2·24	3·30	1,240
1914					1916[1]				
May 21	763	4·46	4·8	3,410	June 2	....	....	4·45	2,660
June 19	973	5·41	6·1	5,360	Aug. 14	....	....	4·85	3,880
" 27	902	6·11	5·6	5,520	Sept. 2	....	....	5·95	4,590
					Nov. 4	....	....	2·68	622

[1] From "Miscellaneous Meter Measurements," *W. R. Paper No. 91.* p. 352.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area[1]
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1914						1915				
April....	....	....	....	....	....	April...	3,290	749	1,950	4·24	4·73
May....	4,710	2,470	3,480	7·56	8·72	May...	5,290	2,390	3,270	7·11	8·20
June....	7,560	3,100	5,040	10·95	12·23	June...	5,960	2,470	3,730	8·11	9·05
July....	8,630	3,030	5,840	12·70	14·63	July...	6,150	3,730	5,010	10·90	12·56
Aug.....	5,340	2,260	3,470	7·54	8·69	Aug....	6,950	4,000	5,340	11·60	13·37
Sept.....	2,960	1,090	1,890	4·10	4·57	Sept....	3,380	972	1,640	3·57	3·98
Oct......	2,260	890	1,360	2·96	3·41	Oct....	2,240	670	1,150	2·50	2·88
Nov.....	1,740	790	1,060	2·30	2·57	Nov....	1,460	596	797	1·73	1·93
Dec.....	690	....	400	0·87	1·00	Dec....	596	310	455	0·99	1·14
Period...	8,630	....	2,818	6·13	55·82	Period..	6,950	310	2,594	5·64	57·84

51—JONES CREEK—at outlet of lake

Drainage area, 25 square miles

DESCRIPTION OF GAUGING STATION

Location—At outlet of Jones lake, in sec. 28, tp. 3, rge. 27, W. 6th mer.

Records available—April, 1910, to Dec., 1916.

Co-operation—Records on this stream are collected for the Vancouver Power Co. by Messrs. Anderson and Warden, civil engineers, Vancouver.

Drainage area—25 sq. miles ; determined by triangulation survey by Anderson and Warden.

Gauge—Vertical staff, fastened to rock-filled crib ; read daily. A Gurley automatic gauge was installed Nov., 1916, at same section and to same datum.

Channel—Uniform section, with deep water and good control.

Discharge measurements—Well define the rating curve.

Winter flow—Open water practically all year.

Accuracy—A and B.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					Sept. 11	131	1·3	1·24	175
Nov. 3	96	0·5	0·50	52	1914				
1912					July 23	128	1·3	1·22	164
Sept. 18	104	0·8	0·85	87	1915				
1913					April 23	119	1·10	1·02	127
July 24	180	2·3	2·06	411	1916				
					July 14	162	1·90	1·80	309

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......
1910					
April	401	95	161	6·44	7·19
May	745	191	327	13·08	15·07
June	419	168	256	10·24	11·43
July	320	168	217	8·68	9·99
Aug.	191	86	146	5·84	6·73
Sept.	106	59	82	3·28	3·66
Oct.	456	157	260	10·40	11·99
Nov.	619	136	295	11·80	13·17
Dec.	179	96	139	5·56	6·40
Period	745	59	209	8·36	85·63
1911					
Jan.	366	42	95	3·80	4·38
Feb.	42	24	32	1·28	1·33
Mar.	106	20	47	1·88	2·17
April	147	68	91	3·64	4·05
May	335	147	229	9·16	10·55
June	619	226	356	14·24	15·90
July	437	226	317	12·68	14·60
Aug.	214	126	167	6·68	7·68
Sept.	437	96	172	6·88	7·68
Oct.	86	42	63	2·52	2·90
Nov.	384	35	137	5·48	6·11
Dec.	179	68	115	4·60	5·30
Year	619	20	152	6·08	82·65
1912					
Jan.	205	55	85	3·40	3·91
Feb.	190	80	139	5·56	5·96
Mar.	74	49	56	2·24	2·58
April	70	55	63	2·52	2·81
May	320	70	196	7·84	9·04
June	380	170	277	11·08	12·37
July	245	155	211	8·44	9·73
Aug.	320	120	179	7·16	8·25
Sept.	130	60	91	3·64	4·05
Oct.	120	55	80	3·20	3·68
Nov.	320	70	156	6·24	6·95
Dec.	180	70	96	3·84	4·42
Year	380	55	135	5·40	73·77
1913					
Jan.	80	52	59	2·36	2·72
Feb.	260	49	90	3·60	3·74
Mar.	80	55	67	2·68	3·09
April	180	52	95	3·80	4·23
May	395	89	242	9·68	11·16
June	520	320	398	15·92	17·78
July	425	275	350	14·00	16·14
Aug.	290	145	204	8·16	9·40
Sept.	485	98	179	7·16	7·98
Oct.	610	74	199	7·96	9·17
Nov.	320	98	171	6·84	7·64
Dec.	180	55	85	3·40	3·91
Year	610	49	178	7·12	96·96
1914					
Jan.	680	60	173	6·92	7·98
Feb.	70	45	57	2·28	2·37
Mar.	180	65	109	4·36	5·03
April	280	85	158	6·32	7·05
May	280	140	223	8·92	10·28
June	310	150	221	8·84	9·86
July	295	120	213	8·52	9·82
Aug.	140	90	119	4·76	5·49
Sept.	190	70	114	4·56	5·09
Oct.	165	70	96	3·84	4·43
Nov.	325	140	215	8·60	9·60
Dec.	150	50	73	2·92	3·37
Year	680	45	148	5·92	80·37
1915					
Jan.	65	45	53	2·12	2·44
Feb.	47	45	46	1·84	1·92
Mar.	120	45	71	2·84	3·27
April	495	92	180	7·21	8·04
May	255	85	152	6·07	7·00
June	200	120	159	6·35	7·08
July	190	120	150	6·00	6·92
Aug.	140	100	113	4·[illegible]2	5·21
Sept.	92	50	66	2·64	2·95
Oct.	565	50	157	6·28	7·24
Nov.	375	85	134	5·36	5·97
Dec.	227	70	116	4·64	5·35
Year	565	45	116	4·64	[illegible]·39
1916					
Jan.	85	50	59	2·36	2·72
Feb.	390	47	137	5·48	5·91
Mar.	530	92	207	8·28	9·55
April	227	120	157	6·28	7·01
May	375	190	263	10·50	12·10
June	660	255	403	16·10	18·00
July	425	255	357	14·30	16·50
Aug.	270	130	202	8·08	9·32
Sept.	165	78	108	4·32	4·82
Oct.	215	50	77	3·08	3·55
Nov.	495	100	232	9·28	10·40
Dec.	120	55	84	3·36	3·87
Year	660	47	190	7·62	103·75

52—JORDAN RIVER—near mouth

Drainage area, 60 square miles

DESCRIPTION OF GAUGING STATION

Location—Half-mile above mouth.

Records available—Jan., 1908, to Dec., 1911 ; after which date the flow was controlled by the Jordan River development of the British Columbia Electric Railway Co.

Drainage area—Above mouth, 60 sq. miles ; above diversion, about 50 sq. miles.

Winter flow—Open water all year.

Co-operation—The following summaries are computed from records supplied by the British Columbia Electric Railway Co.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1908						1909		
Jan.....	4,680	160	896	14·93	17·20	Jan....	7,040	125	1,301	21·68	25·00
Feb.....	7,000	160	770	12·83	13·84	Feb....	7,320	195	1,032	17·20	17·91
Mar.....	7,700	200	1,295	21·58	24·88	Mar....	2,565	330	525	8·75	10·08
April....	4,300	300	722	12·03	13·43	April...	3,010	330	626	10·43	11·64
May....	1,000	250	417	6·95	8·00	May...	1,110	330	556	9·27	10·68
June....	280	100	193	3·20	3·57	June...	745	115	290	4·83	5·38
July....	220	10	53	0·88	1·01	July...	480	60	115	1·92	2·21
Aug.....	70	10	17	0·28	0·32	Aug....	823	41	114	1·90	2·19
Sept.....	180	25	47	0·78	0·87	Sept...	560	57	106	1·77	1·98
Oct.....	1,990	25	277	4·62	5·31	Oct....	1,690	70	405	6·75	7·77
Nov.....	11,900	130	1,729	28·82	32·15	Nov....	12,340	190	2,444	40·73	45·45
Dec.[1]...	....	....	....	....	....	Dec....	6,020	0	744	12·40	14·29
Period...	11,900	10	583	9·72	120·58	Year...	12,340	0	688	11·47	154·58
			1910						1911		
Jan.....	7,210	5	919	15·32	17·66	Jan....	3,610	275	912	15·20	17·53
Feb.....	6,860	160	753	12·55	13·06	Feb....	540	190	262	4·37	4·55
Mar.....	6,350	300	1,185	19·75	22·77	Mar....	2,580	155	579	9·65	11·12
April....	1,740	370	657	10·95	12·22	April...	1,300	275	555	9·25	10·33
May....	1,010	320	588	9·80	11·30	May...	2,725	540	1,005	16·75	19·32
June....	345	90	193	3·22	3·59	June...	1,010	160	366	6·10	6·80
July....	116	26	53	0·88	1·01	July...	160	60	86	1·43	1·65
Aug....	48	15	20	0·33	0·38	Aug....	60	40	48	0·80	0·92
Sept.....	92	1	16	0·27	0·30	Sept....	680	20	136	2·27	2·53
Oct.....	6,348	129	1,028	17·13	19·75	Oct....	680	40	117	1·95	2·25
Nov.....	10,530	320	1,687	28·12	31·37	Nov....	9,770	60	1,774	29·57	33·00
Dec.....	6,010	320	1,329	22·15	25·53	Dec....	8,060	370	1,455	24·25	27·95
Year....	10,530	1	702	11·70	158·94	Year...	9,770	20	608	10·13	137·95

[1] Gauge washed out, no records available.

53—KASLO CREEK—near mouth

Drainage area, 170 square miles

DESCRIPTION OF GAUGING STATION

Location—At the second highway bridge above the mouth in Kaslo, Kootenay lake.

Records available—May 23, 1914, to Dec. 31, 1915 ; Mar. 1 to Dec. 31, 1916.

Gauge—Chain gauge ; read daily.

Channel—Bed of stream is rough and broken, with boulders, and shifts slightly. The water flows swiftly and at a slight angle to the section.

Discharge measurements—Are made from the bridge.

Winter flow—Creek freezes over during cold spells, but seldom for more than two weeks at a time ; frazil ice is often present.

Accuracy—Rating curve seems fairly good. The results should be within 15 per cent. Results for 1916 are considered to be within 5 per cent up to discharge of 3,000 sec. ft.

General—Kaslo creek and its tributaries are still used for mining purposes, and, near the mouth, the town of Kaslo has a water-power development for lighting purposes. The C.P. Ry. from Kaslo to Sandon and Rosebery follows the valley of the North fork.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					Nov. 10	130	2·17	0·95	282
May 23	282	7·11	2·90	2,000	1916				
June 17	349	9·35	3·75	3,270	Mar. 21	117	2·15	0·94	252
July 22	191	3·86	1·95	737	June 13	270	7·25	3·00	1,960
Sept. 23	131	2·70	1·25	354	" 30	260	7·42	3·05	1,930
Nov. 30	96	2·04	0·85	195	Aug. 1	202	4·75	2·28	955
1915					" 25	157	2·83	1·82	444
Mar. 3	82	1·22	0·40	101	Sept. 3	153	2·80	1·52	428
May 10	266	6·57	2·80	1,750	" 22	119	2·02	1·10	241
July 25	192	4·04	2·00	776	Dec. 1	103	1·37	0·56	141

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug.....	....	....	....	....	....
Sept.....	....	....	....	....	....
Oct.....	....	....	....	....	....
Nov.....	....	....	....	....	....
Dec.....	....	....	....	....	....
Year....	....	....	....	....	....
1915					
Jan.[1]...	138	94	110	0·65	0·75
Feb.[2]...	118	77	90	0·53	0·55
Mar.....	298	82	160	0·94	1·08
April....	1,260	247	645	3·79	4·23
May....	1,910	946	1,270	7·47	8·61
June....	1,790	1,020	1,300	7·64	8·52
July....	1,510	756	1,110	6·53	7·53
Aug	818	427	579	3·41	3·93
Sept.....	383	220	285	1·68	1·87
Oct.....	410	190	264	1·55	1·79
Nov.....	330	157	231	1·36	1·52
Dec.....	205	138	157	0·92	1·06
Year....	1,910	77[3]	517	3·04	41·44

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
June...	4,160	1,420	2,390	14·06	15·70
July...	3,040	790	1,750	10·29	11·86
Aug....	880	355	495	2·91	3·36
Sept....	684	245	375	2·20	2·46
Oct....	395	220	289	1·70	1·96
Nov....	458	182	291	1·71	1·91
Dec.[1]...	192	115	133	0·78	0·90
Period..	4,160	115	818	4·82	13·35
1916					
Jan....	....	....	....	....	....
Feb....	....	....	....	....	....
Mar....	288	104	166	0·98	1·13
April...	905	210	437	2·57	2·87
May...	1,930	700	1,120	6·59	7·60
June...	6,790	1,150	2,940	17·30	19·30
July...	3,760	820	1,980	11·60	13·40
Aug....	950	382	586	3·44	3·97
Sept....	560	225	316	1·86	2·07
Oct....	225	156	180	1·06	1·22
Nov....	216	124	150	0·88	0·98
Dec....	140	80	109	0·64	0·74
Period..	6,790	80	798	4·69	53·28

[1] Partly estimated. [2] Ice conditions obtained Jan. 23 to Feb. 6 ; mean discharge estimated. [3] Feb. 20.

54—KETTLE RIVER—at Carson

Drainage area, 2,390 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Carson, 4 miles south of Grand Forks.

Records available—Sept. 5 to Dec. 31, 1913 ; Jan. 1 to 22, and Feb. 25 to Dec. 9, 1914 ; Mar. 1 to Nov. 30, 1915 ; Mar. 1 to Dec. 30, 1916.

Gauge—Movable staff gauge, situated on downstream side of highway bridge 4 miles from Grand Forks. Changed to chain gauge Mar. 20, 1915.

Channel—Straight at measuring section ; bed of stream gravel and sand ; control good.

Discharge measurements—Are made from highway bridge.

Winter flow—Partial ice conditions prevail during December, January and February.

Accuracy—Is considered good, and results should fall within 10 per cent.

General—This station gives the discharge of the Kettle river as it flows north across the international boundary before joining the Granby river at Grand Forks.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 19	1,460	5·37	7·45	7,840[1]
June 9	1,161	3·62	5·65	4,200[1]
July 23	693	0·99	2·50	684[1]
Aug. 24	560	0·39	1·70	221[1]
1915				
Mar. 20	615	0·52	1·96	324[2]
June 11	1,022	4·20	4·98	4,300
1916				
Mar. 11	585	0·53	1·92	310
June 24	1,219	[illegible]	6·00	4,759
Aug. [illegible]	748	1·34	3·11	1,001
1917				
Jan. 17	268	[illegible]		136[3]

[1] Gauge height to datum new gauge. [2] New gauge, established Mar. 20, 1915. [3] Ice.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1913						**1914**					
Jan.	...	...	...	...	...	Jan.	555	375	453	0·19	0·16
Feb.	...	...	...	...	...	Feb.	...	...	...	...	...
Mar.	...	...	...	...	...	Mar.	835	320	506	0·21	0·24
April	...	...	...	...	...	April	5,575	722	3,449	1·44	1·61
May	...	...	...	...	...	May	13,470	4,275	7,001	2·93	3·39
June	...	...	...	...	...	June	7,065	2,560	4,365	1·83	2·04
July	...	...	...	...	...	July	2,450	490	1,230	0·52	0·60
Aug.	...	...	...	...	...	Aug.	490	221	378	0·16	0·18
Sept.[1]	1,070	430	[illegible]	0·24	0·23	Sept.	760	180	343	0·14	0·16
Oct.	1,070	430	626	0·26	0·30	Oct.	1,155	490	717	0·30	0·34
Nov.	760	430	604	0·25	0·28	Nov.	1,113	685	831	0·35	0·39
Dec.	760	430	560	0·23	0·26	Dec.[3]	685	555	...	...	...
Period	...	...	...	...	...	Year[4]	13,470	180	1,700	0·71	9·11
1915						**1916**					
Mar.	620	320	414	0·17	0·20	Mar.	540	200	365	0·15	0·17
April	5,000	760	2,930	1·23	1·37	April	3,920	570	1,640	0·69	0·77
May	9,560	4,100	5,980	2·50	2·88	May	9,340	3,330	5,090	2·13	2·46
June	6,340	1,930	3,274	1·37	1·53	June	8,150	4,590	5,730	2·39	2·67
July	3,630	1,780	2,392	1·00	1·15	July	9,340	1,350	3,390	1·42	1·64
Aug.	2,180	460	1,003	0·42	0·48	Aug.	1,300	540	890	0·37	0·43
Sept.	520	345	389	0·16	0·18	Sept.	600	400	480	0·20	0·22
Oct.	685	320	422	0·18	0·21	Oct.	420	340	390	0·16	0·18
Nov.	620	320	460	0·19	0·21	Nov.	415	260	305	0·13	0·14
Dec.	...	...	...	...	...	Dec.	250	150	200	0·08	0·09
Period	9,560	320	1,918	0·80	8·21	Period	9,340	150	1,850	0·77	8·77

[1] For period Sept. 5 to 30. [2] Jan. 1 to 22. [3] Dec. 1 to [illegible]. [4] Partly estimated. Ice conditions during Feb. and part of Jan. and Dec.

55—KETTLE RIVER—near Nicholson bridge — Drainage area, 1,620 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Nicholson bridge, near Rock creek.

Records available—Mar. 1 to Dec. 11, 1914 ; Feb. 18 to Nov. 30, 1915 ; Mar. 1 to Nov. 13, 1916

Gauge—Standard vertical staff gauge, situated on pier of highway bridge ; read daily.

Channel—Is straight for about 500 feet above and below section ; average width, 150 feet ; bed, gravel and sand, considered permanent. Velocity is high and control good.

Discharge measurements—Four during 1914, two in 1915, and three in 1916 agree well.

Winter flow—Ice conditions exist during January and February.

Accuracy—Considered high, results should be within 5 per cent, except at extreme high water.

General—This station gives the flow of the Kettle river above Midway and above Boundary creek.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					June 9	682	4·16	4·85	2,844
May 20	1,063	5·75	5·00	6,104	1916				
June 7	869	4·86	3·79	4,225	Mar. 17	182	1·45	1·50	263
July 19	329	2·03	0·36	668	June 21	955	4·76	6·07	4,549
Aug. 27	184	0·78	—0·80	144	Aug. 7	354	2·22	2·58	786
1915					1917				
Mar. 25	301	1·50	2·05	466	Jan. 14	124	0·81	....	100[1]

[1] Under ice cover.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......
1915					
Mar.	690	170	300	0·19	0·22
April	5,320	720	2,928	1·81	2·02
May	8,080	4,040	5,521	3·41	3·92
June	5,000	1,480	2,603	1·61	1·80
July	3,580	1,440	2,050	1·26	1·45
Aug.	1,600	280	683	0·42	0·48
Sept.	270	180	225	0·14	0·16
Oct.	515	165	268	0·17	0·20
Nov.	430	330	381	0·24	0·27
Dec.	......	......	......	......	......
Period	8,080	165	1,662	1·03	10·52

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Mar.	735	200	430	0·27	0·31
April	4,730	735	3,007	1·85	2·07
May	9,150	3,630	5,800	3·58	4·12
June	8,055	2,092	4,142	2·55	2·85
July	1,870	265	873	0·54	0·62
Aug.	265	130	193	0·12	0·14
Sept.	550	120	250	0·16	0·18
Oct.	832	320	502	0·31	0·36
Nov.	910	390	587	0·36	0·40
Dec.[1]	390	332	......	......	......
Period[2]	9,150	120	1,755	1·08	11·05
1916					
Mar.	350	250	290	0·18	0·21
April	3,480	350	1,280	0·79	0·88
May	7,730	2,460	4,460	2·75	3·17
June	8,010	4,250	5,250	3·24	3·62
July	7,220	950	2,620	1·62	1·87
Aug.	850	330	560	0·35	0·40
Sept.	360	220	290	0·17	0·19
Oct.	270	170	220	0·14	0·16
Nov.	200	150	170	0·10	0·11
Dec.	150	100	130	0·08	0·09
Period	8,010	100	1,530	0·94	10·70

[1] For period Dec. 1 to 11. [2] For period Mar. to Nov.

56—KHATADA RIVER—near mouth

Drainage area, 60 square miles

DESCRIPTION OF GAUGING STATION

Location—Near the mouth of Khatada river below lake Brutinel. Khatada river is a tributary of the Skeena river, on south bank, about 17 miles above Essington.

Records available—Dec. 7, 1911, to Dec. 6, 1912.

Drainage area—60 sq. miles ; determined by triangulation survey. The drainage area includes several glaciers and snowfields.

General—The following summary has been compiled from records taken and supplied by Messrs. Ritchie, Agnew & Co., engineers, Prince Rupert. This firm, in 1911, 1912 and 1913, made a careful study of the power possibilities of Khatada river and Falls creek, with a view to their future development for power supply to Prince Rupert and district.

MONTHLY SUMMARIES

Month	Discharge in second-feet		Run-off depth in inches on drainage area	Month	Discharge in second-feet		Run-off depth in inches on drainage area
	Mean	Per sq. mile			Mean	Per sq. mile	
1912				**1912**			
January	93	1·55	1·79	August	314	5·25	6·02
February	178	2·97	3·18	September	377	6·28	7·00
March	94	1·57	1·81	October	472	7·87	9·07
April	217	3·61	4·02	November	354	5·90	6·58
May	452	7·53	8·67	December[1]	344	5·73	6·60
June	495	8·25	9·20				
July	468	7·80	8·99	Year	330	5·50	72·93

[1] Includes Dec. 1-6, 1912, and Dec. 7-31, 1911.

57—KICKING HORSE RIVER—near mouth

Drainage area, 700 square miles

DESCRIPTION OF GAUGING STATION

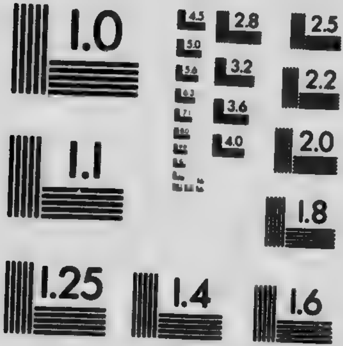
Location—On old highway bridge, in town of Golden.

Records available—Open seasons, 1912 to 1916, also metering under ice conditions.

Gauge—Vertical staff gauge ; read two or three times daily.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



Channel—Straight for 200 yards above and below the station ; control is a gravel bar about 200 yards downstream from section. At high stages water also flows in side channel.

Discharge measurements—Are made from the bridge, and are considered accurate.

Winter flow—Ice conditions prevail and stream becomes choked with anchor ice ; frazil ice will be found practically up to source.

Accuracy—The channel shifts slightly, and new rating curves are plotted from time to time. The results should be within 10 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet ;*	*Sec.-feet*
1911				
Oct. 18	280	1·7	1·72	464
1912				
Feb. 22	185	0·93	....	172
May 24	430	4·3	3·46	1,840
June 4	372	2·7	2·64	999
" 8	507	4·2	3·9	2,390[1]
" 24	928	6·4	5·64	5,970[1]
July 12	654	5·2	4·6	3,340[1]
" 26	604	4·7	4·26	2,830[1]
Sept. 26	363	2·8	2·48	1,030[1]
Oct. 1	351	2·6	2·36	930
1913				
May 22	431	3·67	2·97	1,540
July 5	654	5·60	4·52	3,660
" 5	654	5·50	4·52	3,580
Sept. 4	712	6·47	4·90	4,610
Nov. 20	277	1·40	1·55	384
1914				
Feb. 28	284	0·98	Ice	278[2]
June 11	644	5·51	4·25	3,550
July 28	605	5·12	4·10	3,100
Aug. 6	692	5·94	4·50	4,110
Sept. 11	391	3·30	2·9	1,290
Oct. 14	329	2·77	2·32	912
1915				
Mar. 2	308	0·50	Ice	154[3]
May 15	434	3·92	3·20	1,700
" 18	423	3·78	3·05	1,600
July 5	739	6·97	4·95	5,160
" 14	765	6·95	5·00	5,320
Oct. 26	282	1·94	1·89	548
1916				
July 13	1,070	7·47	6·49	7,960
Aug. 17	690	3·62	4·73	2,500
" 21	550	2·89	4·12	1,600
Nov. 8	408	1·18	2·73	483

[1] Water flowing in side channel. [2] Not reliable, frazil ice. [3] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
April....	....	....	....	....	....
May....	....	....	....	....	....
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
1912					
April[1]...	365	180	224	0·32	0·26
May...	2,760	295	1,410	2·01	2·32
June...	5,870	980	3,570	5·10	5·68
July...	3,480	2,560	3,080	4·40	5·07
Aug....	6,720	2,250	3,230	4·61	5·30
Sept....	2,190	830	1,530	2·19	2·44
Oct[2]...	1,000	400	731	1·04	1·20
1913					
April[3]...	1,260	650	836	1·20	0·71
May....	6,320	416	1,817	2·60	3·00
June....	9,580	3,390	2,760	3·94	4·40
July....	5,660	2,500	4,020	5·70	6·57
Aug....	4,760	2,250	3,430	4·90	5·65
Sept....	4,240	1,420	2,060	2·94	3·28
Oct....	1,420	650	939	1·34	1·54
Nov....	730	181	493	0·70	0·78
Dec....	....	....	....	....	....
1914					
April...	....	....	....	....	....
May...	3,800	1,040	2,220	3·17	3·66
June...	8,510	3,030	5,140	7·34	8·19
July...	7,910	3,070	5,460	7·80	8·99
Aug....	4,750	2,100	3,160	4·51	5·20
Sept....	2,630	830	1,480	2·11	2·35
Oct....	1,520	563	914	1·30	1·50
Nov....	647	185	454	0·65	0·72
Dec.[4]...	485	....	248	0·35	0·40
1915					
April....	1,520	266	751	1·07	1·19
May....	3,750	1,620	2,310	3·30	3·80
June....	7,840	1,950	3,590	5·13	5·72
July....	6,510	3,470	5,030	7·19	8·29
Aug....	5,490	3,600	4,380	6·26	7·22
Sept....	2,880	785	1,410	2·01	2·24
Oct....	891	460	639	0·91	1·05
Nov....	690	250	443	0·63	0·70
Dec....	....	....	....	....	....
Period...	7,840	250	2,319	3·31	30·21
1916					
April...	762	230	375	0·53	0·59
May...	1,960	650	1,330	1·90	2·19
June...	14,200	1,780	4,300	6·14	6·85
July...	8,180	2,570	5,050	7·21	8·31
Aug....	3,600	1,600	2,680	3·83	4·42
Sept...	3,010	840	1,720	2·46	2·75
Oct....	1,180	540	681	0·97	1·12
Nov.[5]...	....	....	469	0·67	0·75
Dec.[5]...	....	....	350	0·50	0·58
Period..	14,200	......	1,880	2·69	27·56

[1] For period April 9 to 30. In 1911 freeze-up occurred on Nov. 11 ; on Nov. 9, due possibly to ice jam above, the discharge dropped to 95 sec. ft. (open conditions at gauge). Channel opened in 1912 on April 8. [2] Freeze-up in 1912 about middle of November. [3] For period April 15 to 30. [4] Partly estimated. [5] Gauge height-discharge relation affected by ice and discharge estimated from gauge records; discharge measurements and climatic conditions, Nov. 13 to 30, 450 sec. ft., Dec., as shown.

58—KICKING HORSE RIVER—near Field

Drainage area, 130 square miles.

DESCRIPTION OF GAUGING STATION

Location—Below mouth of Yoho river, on the first traffic bridge, 3¼ miles east of Field.

Records available—June to Nov., 1912 ; June to Dec., 1913 ; June to Dec., 1914 ; April to Dec., 1915 ; Jan. to Dec., 1916.

Gauge—Chain gauge is used, referenced to 3 bench marks ; read three or more times a week ; daily during May to September, 1915.

Channel—Is straight for 50 yards above and below the station ; bed, gravelly. The water is very swift during freshet and the control shifted slightly in 1914 and again in 1915. The river is confined between bridge abutments at all stages.

Discharge measurements—Are made from the traffic bridge.

Winter flow—The river near Field is generally frozen for three or four months and frazil ice is always apt to be a menace.

Accuracy—Fair. A slight shift in the channel was noted, but the 1912 rating curve was still used in 1914 ; new curves in 1915 and 1916.

General—An interesting feature of the run-off conditions on this stream is the diurnal variation due to the melting of the glaciers and snowfields ; on a hot, clear day, the difference between the minimum and maximum flow may exceed 2,000 sec.-ft.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912				
June 6	120	2·46	4·4	295
" 25	403	8·88	7·0	3,600
" 26	488	9·65	7·6	4,710
" 29	325	8·05	6·4	2,620
July 2	272	7·1[illegible]	6·0	1,940
Aug. 13	192	[illegible]·00	5·35	963
Oct. 2	102	2·10	3·70	214
Nov. 19	74	1·60	3·10	116
1913				
May 22	126	2·40	4·15	300
July 3	220	5·82	5·70	1,280
" 28	300	7·40	6·30	2,220
" 30	206	5·90	5·55	1,200
" 31	281	7·70	6·20	2,190
Aug. 28	297	7·80	6·30	2,300
Sept. 12	155	3·20	4·80	496
Dec. 1	55	1·5[illegible]	2·95	86
1914				
June 14	218	6·41	5·6	1,410
July 29	227	6·49	5·5	1,470
Sept. 12	137	2·84	4·3	390
" 21	116	2·35	4·10	272
Oct. 16	103	1·93	3·65	199
1915				
Mar. 10	45	0·90	Ice	41[1]
May 9	168	4·57	4·80	769
" 17	125	2·60	4·10	324
July 3	207	6·39	5·30	1,320
" 14	230	6·61	5·70	1,520
Oct. 20	68	1·63	3·40	111
Nov. 27	60	1·20	3·15	72
1916				
April 3	63	0·65	2·70	41[1]
June 18	273	6·78	6·45	1,850
July 2	240	5·92	5·90	1,420
Aug. 10	158	3·65	4·95	582
" 30	271	6·16	6·30	1,670
Nov. 7	70	1·59	3·36	111

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
June....	....	....	....	....	....
Jul	....	....	....	....	....
[illegible]	....	....	....	....	....
Sept.....	....	....	....	....	....
Oct.....	....	....	....	....	....
Nov.....	....	....	....	....	....
1913					
June....	2,870	810	1,700	13·08	1[illegible]·60
July....	3,050	715	1,870	14·40	16·60
Aug.....	2,870	810	1,900	14·61	16·85
Sept.....	910	300	502	3·86	4·31
Oct.....	275	115	163	1·25	1·44
Nov.....	115	95	106	0·82	0·91
Dec.....	95	75	82	0·63	0·73
Period...	3,050	75	903	6·94	55·44

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1912					
June...	4,380[1]	200	1,380	14·46	16·15
July..	2,760	1,260	1,920	14·77	17·02
Aug....	4,180	670	2,120	16·30	18·80
Sept....	595	185	340	2·61	2·91
Oct...	200	130	159	1·22	1·41
Nov..	120	120	120	0·92	1·03
1914					
June...	2,180	560	1,500	11·54	12·89
July...	3,260	1,050	2,250	17·31	19·95
Aug...	2,660	925	1,770	13·61	15·70
Sept....	1,250	192	485	3·73	4·16
Oct....	275	125	196	1·51	1·74
Nov...	148	110	126	0·97	1·08
Dec....	110	100	108	0·83	0·96
Period.	3,260	100	919	7·06	56·48

[1] On June 26, a maximum flow of 4,760 was recorded ; this lasted for a few hours only, the mean for the day being 4,380.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1915					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	305	45	121	0·93	1·04
May	1,030	266	484	3·72	4·29
June	2,000	449	953	7·33	8·18
July	2,600	1,220	1,780	13·69	15·80
Aug.	3,500	2,060	2,900	22·30	25·70
Sept.	3,060	266	948	7·29	8·13
Oct.	284	112	190	1·46	1·68
Nov.	112	69	87	0·67	0·75
Dec.[2]	69	53	....	....	....
Period	3,500	45	933	7·17	65·57
1916					
Jan.[3]	....	....	45	0·35	0·40
Feb.	....	....	40	0·31	0·33
Mar.	....	....	41	0·31	0·36
April	55	34	43	0·33	0·37
May	186	55	148	1·14	1·31
June	2,480	166	1,080	8·31	9·27
July	1,900	725	1,190	9·15	10·05
Aug.	1,790	560	913	7·02	8·09
Sept.	1,380	186	622	4·78	5·33
Oct.	290	114	169	1·30	1·50
Nov.	....	....	93	0·71	0·79
Dec.	....	....	65	0·50	0·58
Year	2,480	....	371	2·85	38·83

[2] Dec. 1 to 25; after 25th ice conditions obtained. [3] Gauge height-discharge relation affected by ice and discharge estimated from gauge records, meter measurements and climatic conditions, for months of Jan., Feb., Mar., Nov. and Dec., as shown.

59—KICKING HORSE RIVER—near No. 2 Tunnel

Drainage area, 50 square miles

DESCRIPTION OF GAUGING STATION

Location—Above mouth of Yoho river, immediately above C.P.R. bridge over the Kicking Horse between Nos. 1 and 2 tunnels; 5 miles east of Field.

Records available—July to Oct., 1912; April, 1913, to Dec., 1915; July to Dec., 1916.

Gauge—Vertical staff; read once or twice daily.

Channel—Is straight for 25 yards above and below the section. The control (1916) is permanent. (Compare *Water Supply Papers* Nos. 1, 8, 14, 18 and 21.)

Discharge measurements—Are made from the bridge or by wading.

Accuracy—At high water, the measuring section is not very satisfactory. The results are probably within 20 to 25 per cent; in 1916, 10 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912				
June 28	110·0	4·01	5·00	470
July 2	83·5	3·58	4·20	299
Aug. 5	94·4	3·94	4·45	378
" 13	81·0	3·33	3·85	270
Oct. 2	26·6	2·24	2·08	59·5[1]
Nov. 19	11·5	2·70	1·73	30·8[1]
1913				
May 21	28·2	2·50	2·45	73·3
July 3	80·5	4·00	3·85	320
" 28	89·6	3·72	3·90	335
" 30	63·5	3·60	2·50[2]	230
Aug. 28	64·4	3·92	2·38	252
Dec. 1	10·8	2·40	0·90	25·3
1914				
June 14	69·0	5·84	3·40	403[3]
July 29	51·1	5·16	1·95	264[3]
Aug. 7	57·8	5·16	2·15	300[3]
Sept. 12	28·6	3·19	1·20	91·4[3]
" 21	30·2	2·76	1·20	108[4]
Oct. 16	27·2	3·08	0·95	83·8[3]
1915				
Mar. 10	11·8	0·77	0·35	9·06[5]
May 9	44·1	4·53	2·10	200
" 17	30·7	2·78	1·40	85·5
July 3	72·8	5·83	3·70	424
" 14	66·8	5·84	3·80	390
Oct. 20	12·2	3·48	0·80	42·1
Nov. 27	9·27	2·40	0·48	22·2
1916				
June 18	112·0	7·33	5·55	822
July 2	85·2	6·28	4·30	535
Aug. 30	44·1	4·17	2·38	184
Nov. 7	14·0	2·13	0·56	29·8

[1] Different section. [2] Gauge datum raised one foot. [3] From C.P.R. bridge. [4] Wading, different section. [5] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	52	25	34	0·68	0·76
May	396	17	94	1·88	2·17
June	770	222	438	8·76	9·77
July	491	187	341	6·82	7·86
Aug.	517	204	291	5·82	6·71
Sept.	351	96	170	3·40	3·79
Oct.	96	42	60	1·20	1·38
Nov.	42	25	32	0·64	0·71
Dec.[1]	21	21	21	0·42	0·48
Period	770	17	165	3·30	33·73
1915					
Jan.	12·6	12·6	12·6	0·25	0·29
Feb.	12·6	8·8	10·2	0·20	0·22
Mar.	12·6	8·8	10	0·20	0·23
April	78	12·6	35	0·70	0·78
May	214	80	118	2·36	2·72
June	832	112	278	5·56	6·20
July	496	251	412	8·24	9·50
Aug.	409	262	321	6·42	7·40
Sept.	259	51	95	1·89	2·11
Oct.	61	36	44	0·88	1·02
Nov.	36	19	26	0·52	0·58
Dec.	24	19	20	0·40	0·46
Year	832	8·8	115	2·30	31·51

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1912					
July	360	256	310	6·20	7·13
Aug.	784	175	334	6·68	7·70
Sept.	150	60	100	2·00	2·23
Oct.	60	40	50	1·00	1·15
1914					
Jan.	23	23	23	0·46	0·53
Feb.	23	15	19	0·38	0·40
Mar.	15	15	15	0·30	0·35
April	77	15	29	0·58	0·65
May	241	90	153	3·06	3·53
June	537	145	302	6·04	6·74
July	440	230	328	6·56	7·56
Aug.	367	166	236	4·72	5·44
Sept.	230	63	121	2·42	2·70
Oct.	138	40	83·5	1·67	1·92
Nov.	40	31	32·8	0·66	0·74
Dec.	31	19	26·7	0·53	0·61
Year	537	15	114	2·28	31·17
1916					
Jan.[2]	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	787	215	471	9·42	10·90
Aug.	382	132	250	5·00	5·76
Sept.	307	70	160	3·20	3·57
Oct.	113	44	56	1·12	1·29
Nov.	44	22	29	0·58	0·65
Dec.[2]	....	....	14	0·28	0·32
Period	....	....	163	3·27	22·49

[1] Dec., 1913, partly estimated. [2] No gauge reader available Jan. to June. Discharge estimated Dec. 11 to 31, 12 c.f.s.

60—KOKSILAH RIVER—near mouth

Drainage area, 124 square miles

DESCRIPTION OF GAUGING STATION

Location—2 miles from mouth, upstream side of Esquimalt and Nanaimo Ry. bridge ; 2 miles south from Duncan.

Records available—May 12, 1914, to Dec. 31, 1916.

Co-operation—Provincial Water Rights Branch installed gauge in 1911.

Gauge—Fourteen-foot staff on left bank, 600 feet above bridge ; read daily.

annel—Gravel bed ; two channels in low water ; channel straight for 100 feet above and for 300 feet below section ; good control.

Discharge measurements—One in 1911 and one in 1913 by Provincial Water Rights Branch ; six in 1914, three in 1915 and four in 1916 by British Columbia Hydrometric Survey.

Winter flow—Open all year.

Accuracy—Good ; monthly summary given below for 1914 embodies revisions based on later measurements. See NOTE page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911					1915				
Dec 14	157	2·02	1·5 [1]	318 [2]	Mar. 23	135	2·15	2·43	291
1913					Aug. 28	26	0·40	1·03	10·5 [5]
Jan. 28	192	3·75	2·08 [1]	702	Dec. 8	1,210	4·83	9·50	5,840 [6]
1914					1916				
May 12	87	1·3	1·73	110 [3]	Mar. 27	470	3·81	5·20	1,790
July 5	18	1·8	1·23	33·9 [4]	" 28	364	3·64	4·28	1,330
Aug. 12	94	0·2	1·00	14·4	Nov. 5	223	3·10	3·30	691
" 12	14	1·1	1·15	16·2	Dec. 12	177	2·81	2·84	507
" 27	12	0·9	1·00	10·1					
Nov 25	462	3·6	4·92	1,650					

[1] Not the same datum as subsequent measurements. [2] 580 feet above E. & N. Ry. bridge. [3] New station established by Hydrometric Survey. [4] Different sections used. [5] Not at regular section. [6] Extreme high water.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1914					
May	....	....	....	....	....	May [1]	100	45	68	0·55	0·41
June	....	....	....	....	....	June	120	35	52	0·42	0·47
July	....	....	....	....	....	July	33	21	23	0·19	0·22
Aug.	....	....	....	....	....	Aug.	21	12	14	0·11	0·13
Sept.	....	....	....	....	....	Sept.	100	12	36	0·29	0·32
Oct.	....	....	....	....	....	Oct.	2,060	35	364	2·93	3·38
Nov.	....	....	....	....	....	Nov.	2,140	270	765	6·16	6·86
Dec.	....	....	....	....	....	Dec.	790	100	260	2·10	2·42
Period	....	....		....	....	Period	2,140	12	198	1·60	14·21
1915						1916					
Jan.	1,700	160	550	4·44	5·12	Jan.	[illegible]90	340	427	3·44	3·97
Feb.	590	270	360	2·90	3·02	Feb.	1,420	420	755	6·09	6·57
Mar.	790	340	480	3·87	4·46	Mar.	1,980	590	989	7·98	9·20
April	1,560	160	440	3·55	3·96	April	1,150	590	766	[illegible]·18	6·90
May	180	60	114	0·92	1·06	May	790	210	470	3·79	4·37
June	80	17	42	0·34	0·38	June	420	120	181	1·46	1·63
July	25	12	22	0·18	0·21	July	590	25	145	1·17	1·35
Aug.	19	11	14·6	0·12	0·14	Aug.	80	7	19	0·15	0·17
Sept.	9	7	7·9	0·06	0·07	Sept.	35	3	9	0·07	0·08
Oct.	2,620	25	390	3·14	3·62	Oct.	1,840	2	96	0·77	0·89
Nov.	2,620	420	926	7·47	8·33	Nov.	1,700	270	520	4·19	4·68
Dec.	5,530	500	1,390	11·20	12·90	Dec.	690	270	436	3·52	4·06
Year	5,530	7	395	3·18	43·27	Year	1,980	2	402	3·24	43·87

[1] For period May 12 to 31.

61—**KOOSKANAX CREEK**—near mouth

Drainage area, 125 square miles

DESCRIPTION OF GAUGING STATION

Location—At bridge over cañon, 1 mile from Nakusp and about 1 mile from the mouth.

Records available—Mar. 19, 1914, to Dec., 1915. Station discontinued in 1916.

Gauge—Chain gauge at the bridge ; read twice a week.

Channel—The river is confined between perpendicular walls, 38 feet apart at the gauging and measuring section. The control is a sand and gravel bar and seems fairly permanent.

Discharge measurements—Nine in 1914, six in 1915.

Winter flow—Frazil ice may be expected for a few days at a time only.

Accuracy—Infrequency of gauge readings impairs accuracy, especially during May, June and July; results, however, should be within 20 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914				
Mar. 19	204	0·59	0·7	122
May 16	274	5·63	4·2	1,540
June 13	273	4·30	3·50	1,150
" 20	275	5·40	3·80	1,480
" 28	293	[illegible]·73	3·34	1,300
Aug. 12	229	[illegible]·07	1·1	245
Sept. 4	221	0·62	0·65	137
Oct. 28	240	1·28	1·15	309

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
Nov. 23	230	0·95	1·2	220
1915				
Mar. 20	209	0·55	0·50	115
May 17	221	3·36	2·60	747
" 27	250	4·50	3·00	1,120
June 22	265	2·92	2·25	774
Sept. 11	150	0·74	0·75	150
Nov. 29	222	0·80	0·78	177

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April	1,080	115	530	4·24	4·74
May	1,880	920	1,330	10·64	12·24
June	1,820	1,410	1,600	12·80	14·30
July	1,590	1,060	1,350	10·80	12·44
Aug.	990	141	362	2·90	3·34
Sept.	670	102	272	2·18	2·43
Oct.	720	315	517	4·14	4·77
Nov.	395	235	336	2·69	3·00
Dec.	235	115	178	1·42	1·64
Period.	1,880	102	719	5·75	58·90

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
Jan.	195	151	164	1·31	1·51
Feb.	155	115	125	1·00	1·04
Mar.	151	115	127	1·01	1·16
April	1,190	162	695	5·56	6·20
May [1]	......	......	......	......	......
June	1,340	683	869	6·95	7·75
July	1,070	340	661	5·29	6·10
Aug.	329	151	213	1·70	1·96
Sept.	184	142	156	1·25	1·39
Oct.	455	162	238	1·90	2·19
Nov.	397	162	235	1·88	2·10
Dec.	162	130	140	1·12	1·29
Period.	1,340	115	329	2·63	32·69

[1] Gauge heights May 6 to 26 not available.

62—K[illegible]TENAY RIVER—at Glade

Drainage area, 19,100 square miles*

DESCRIPTION OF GAUGING STATION

Location—At the ferry cable near Glade, 10 miles from the mouth, below the Slocan river, 16 miles from Nelson.

Records available—May, 1913, to Dec., 1916.

Gauge—Vertical staff in five sections ; read twice daily.

Channel—Is straight for ¼ mile above and below section and very uniform. There are riffles 1,000 yards above and below the section, which is an ideal one for metering purposes.

Discharge measurements—Are made from a cable car used on a ferry cable. The rating curve is considered satisfactory.

Winter flow—The river never freezes over.

Accuracy—A, considered very good.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913				
June 13	16,000	9·63	24·5	154,000
July 3	12,400	8·38	19·8	104,000
" 31	8,930	6·21	14·6	55,500
Aug. 6	8,450	6·08	13·85	51,400
Sept. 6	6,980	4·81	11·50	33,600
Nov. 27	4,940	3·05	7·82	15,100
1914				
Jan. 13	4,580	2·82	2·52	12,900
" 31	4,620	2·82	7·40	13,000
Mar. 9	4,000	2·22	1·57	8,900
June 1	11,370	7·79	13·35	88,600
July 20	10,800	7·54	12·60	81,400
Aug. 11	7,916	5·46	8·22	43,200

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
Aug. 13	7,700	5·25	7·80	40,400
Dec. 11	5,020	3·42	3·45	17,200
1915				
Mar. 9	3,600	2·24	1·07	8,080
April 19	6,720	4·48	5·87	30,100
1916				
Mar. 10	3,870	2·25	1·65	8,720
June 3	9,980	6·89	11·30	68,800
" 26	16,300	10·17	20·05	165,800
July 19	14,100	9·60	17·10	135,200
Aug. 11	[illegible],620	6·54	10·55	62,900
" 28	[illegible],690	5·64	7·75	43,400
Oct. 2	[illegible],270	3·68	4·64	19,400
Dec. 6	3,950	2·33	1·88	9,220

* Possibly low, a revised estimate based on recent measurements suggests 19,400 square miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						**1914**					
Jan.	....	....	....	....	....	Jan.	13,400	8,700	11,700	0·61	0·70
Feb.	....	....	....	....	....	Feb.	11,800	8,330	9,430	0·49	0·51
Mar.	....	....	....	....	....	Mar.	13,100	8,330	10,400	0·54	0·62
April	....	....	....	....	....	April	42,500	13,100	26,500	1·39	1·55
May [1]	77,200	32,300	45,400	2·39	2·76	May	89,600	43,200	70,600	3·70	4·27
June [1]	154,000	93,000	126,000	6·60	7·36	June	102,000	88,600	96,100	5·03	5·61
July	108,000	56,300	78,900	4·13	4·75	July	93,600	58,200	82,300	4·31	4·97
Aug.	54,700	32,100	42,900	2·25	2·59	Aug.	57,400	26,900	39,600	2·07	2·39
Sept.	33,600	23,100	28,600	1·50	1·67	Sept.	26,400	19,500	21,400	1·12	1·25
Oct.	22,100	18,000	19,400	1·02	1·18	Oct.	20,400	18,100	19,300	1·01	1·16
Nov.	17,000	15,000	15,900	0·84	0·94	Nov.	25,800	19,200	22,500	1·18	1·32
Dec.	15,000	9,900	12,400	0·65	0·75	Dec.	19,500	10,500	14,400	0·75	0·86
Period	....	....	....	....	....	Year	102,000	8,330	35,352	1·85	25·21
1915						**1916**					
Jan.	10,900	8,400	9,940	0·52	0·60	Jan.	10,900	7,580	8,520	0·45	0·52
Feb.	8,690	8,110	8,260	0·43	0·45	Feb.	9,610	7,830	8,440	0·44	0·48
Mar.	11,300	8,110	8,940	0·47	0·54	Mar.	22,000	9,290	14,200	0·74	0·85
April	40,500	11,700	24,800	1·30	1·45	April	39,100	22,000	29,100	1·52	1·70
May	59,000	41,200	52,300	2·74	3·16	May	70,500	39,800	61,900	3·24	3·73
June	58,200	51,800	55,000	2·88	3·21	June	162,000	70,500	110,000	5·76	6·43
July	57,800	48,700	54,100	2·83	3·26	July	157,000	87,300	129,000	6·77	7·80
Aug.	48,700	32,600	39,900	2·09	2·41	Aug.	83,900	36,400	56,400	2·95	3·40
Sept.	32,200	17,700	23,600	1·24	1·38	Sept.	36,100	23,200	30,200	1·58	1·76
Oct.	17,300	13,900	15,000	0·79	0·91	Oct.	22,800	13,500	17,000	0·89	1·03
Nov.	15,600	12,800	14,400	0·75	0·84	Nov.	14,100	10,000	12,500	0·65	0·72
Dec.	12,800	9,940	11,500	0·60	0·69	Dec.	10,900	7,830	9,470	0·49	0·56
Year	59,000	8,100	26,478	1·39	18·90	Year	162,000	7,580	40,560	2·12	28·98

[1] Results for May and June, 1913, are deduced from measurements of the flow of the Columbia, above and below the mouth of the Kootenay, at Castlegar and Trail.

63—KOOTENAY RIVER—at Upper Bonnington falls — Drainage area, 17,800 square miles*

DESCRIPTION OF GAUGING STATION

Location—At the headrace of the West Kootenay Power and Light Co.'s plant No. 2, at Upper Bonnington, 10 miles west of Nelson and 16 miles from the mouth.

Records available—Oct., 1907, to Dec., 1915.

Co-operation—Gauge readings by the West Kootenay Power and Light Co.

Gauge—The elevation of the water each day is determined by measuring down to the surface from a known point. The gauge is situated at a point at the upstream end of the headrace, where part of the water is diverted to the turbines, and the remainder flows over the falls, some 200 feet below.

Discharge measurements—The only metering section on Kootenay river between the lake and the mouth is near Glade, about 6 miles below Upper Bonnington. The only large stream entering between these points is Slocan river. The rating curve for the Kootenay at Bonnington falls is obtained by subtracting the discharge of Slocan river from the discharge of the Kootenay river near Glade.

Winter flow—Owing to the warming influence of Kootenay lake, the river below the lake never freezes over and very little, if any, frazil ice or anchor ice is formed.

Accuracy—These data appear to agree well with similar data gathered in recent years, at Bonnington pool and near Nelson. See Accuracy notes for Kootenay at Nelson, and for Slocan river.

* Possibly nearer 18,000 square miles.

MONTHLY SUMMA[illegible]

Month	Discharge in second-feet Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
1908					
Jan.	10,200	7,800	8,880	0·50	0·58
Feb.	7,500	7,200	7,200	0·40	0·43
Mar.	11,800	7,000	8,600	0·48	0·55
April	43,200	11,800	21,700	1·22	1·36
May	73,000	43,200	63,800	3·58	4·13
June	113,000	73,000	94,100	5·29	5·90
July	92,000	61,700	72,100	4·05	4·67
Aug.	59,900	27,000	39,700	2·23	2·57
Sept.	25,200	16,900	21,300	1·21	1·35
Oct.	16,400	11,400	13,300	0·75	0·86
Nov.	12,200	10,200	10,300	0·58	0·65
Dec.	13,800	7,200	10,100	0·57	0·66
Year	113,000	7,000	30,923	1·74	23·71
1910					
Jan.	12,200	8,400	9,240	0·52	0·60
Feb.	8,700	7,000	8,070	0·45	0·47
Mar.	21,400	7,200	12,500	0·70	0·81
April	60,800	21,400	32,900	1·85	2·06
May	84,000	63,500	73,800	4·15	4·78
June	88,000	70,000	78,900	4·43	4·94
July	68,000	41,100	55,400	3·11	3·58
Aug.	40,400	21,400	30,000	1·68	1·94
Sept.	20,800	14,200	16,200	0·91	1·02
Oct.	19,300	14,600	17,200	0·97	1·12
Nov.	19,800	17,400	18,600	1·04	1·16
Dec.	18,800	12,200	14,400	0·81	0·93
Year	88,000	7,000	30,601	1·72	23·41
1912					
Jan.	7,200	5,700	6,070	0·34	0·39
Feb.	6,300	5,700	5,880	0·33	0·36
Mar.	6,200	5,600	5,820	0·33	0·38
April	22,400	6,000	14,000	0·79	0·88
May	59,900	22,900	40,500	2·27	2·62
June	63,500	54,300	59,200	3·32	3·70
July	59,000	42,500	49,300	2·77	3·19
Aug.	42,500	27,600	33,600	1·88	2·17
Sept.	26,400	16,900	21,700	1·22	1·36
Oct.	16,400	13,000	13,800	0·78	0·90
Nov.	14,200	11,400	12,800	0·71	0·79
Dec.	12,200	7,500	10,100	0·57	0·66
Year	63,500	5,600	22,731	1·28	17·40
1914					
[illegible]	[illegible]	7,800	10,300	0·58	0·67
[illegible]	[illegible]	7,000	8,230	0·46	0·48
[illegible]	[illegible]	7,500	9,250	0·52	0·60
[illegible]	[illegible]	11,800	22,400	1·26	1·41
[illegible]	[illegible]	37,600	59,400	3·33	3·84
[illegible]	[illegible]	76,000	83,100	4·66	5·20
[illegible]	82,000	52,800	73,000	4·10	4·73
[illegible]	52,000	25,200	36,300	2·04	2·34
Sept.[1]	23,500	18,600	19,900	1·12	1·25
Oct.	19,000	17,100	18,100	1·02	1·18
Nov.	23,000	17,900	20,600	1·16	1·29
Dec.	18,100	9,800	14,100	0·79	0·91
Year	88,000	7,000	31,223	1·75	23·90

Month	Discharge in second-feet Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1907					
Oct.	36,200	19,400	26,200	1·47	1·70
Nov.	18,800	9,900	14,200	0·80	0·89
Dec.	13,000	9,600	11,100	0·62	0·72
1909					
Jan.	8,100	6,800	7,350	0·41	0·47
Feb.	8,100	7,500	7,740	0·44	0·46
Mar.	8,100	7,500	7,650	0·43	0·50
April	13,800	8,400	10,800	0·61	0·68
May	54,500	14,200	27,100	1·52	1·75
June	110,000	59,000	98,200	5·52	6·16
July	99,000	57,200	81,500	4·58	5·28
Aug.	55,400	26,400	40,200	2·26	2·61
Sept.	24,600	16,400	20,100	1·13	1·26
Oct.	16,400	13,000	14,900	0·84	0·97
Nov.	15,400	12,200	13,200	0·74	0·83
Dec.	18,800	10,200	15,800	0·89	1·03
Year	110,000	6,800	28,712	1·61	22·00
1911					
Jan.	11,800	7,000	8,670	0·49	0·56
Feb.	8,100	6,400	7,480	0·42	0·44
Mar.	13,800	6,300	8,120	0·46	0·53
April	31,200	14,200	18,100	1·01	1·13
May	56,300	31,800	48,100	2·70	3·11
June	104,000	56,300	85,300	4·78	5·33
July	102,000	54,500	77,000	4·32	4·98
Aug.	52,800	27,000	38,800	2·18	2·51
Sept.	27,000	17,900	22,400	1·26	1·41
Oct.	17,400	11,000	14,100	0·79	0·91
Nov.	11,000	8,400	9,610	0·54	0·60
Dec.	10,200	6,800	8,090	0·45	0·52
Year	104,000	6,300	28,814	1·62	22·03
1913					
Jan.	9,000	6,600	7,490	0·42	0·48
Feb.	7,000	6,100	6,490	0·36	0·38
Mar.	7,200	5,900	6,610	0·37	0·43
April	32,400	7,200	15,800	0·89	0·99
May	80,000	32,400	44,600	2·51	2·89
June	137,000	84,000	114,000	6·40	7·14
July	94,000	50,400	70,200	3·94	4·54
Aug.	50,400	31,200	38,800	2·18	2·5
Sept.	31,200	20,300	26,700	1·50	1·67
Oct.	20,300	14,600	17,600	0·99	1·14
Nov.	15,000	11,000	13,300	0·75	0·84
Dec.	13,000	7,800	10,200	0·57	0·66
Year	137,000	5,900	30,983	1·74	23·66
1915					
Jan.	9,740	7,520	8,690	0·49	0·57
Feb.	7,660	7,000	7,370	0·41	0·43
Mar.	9,220	7,130	7,630	0·43	0·50
April	34,700	9,390	20,300	1·14	1·27
May	49,900	35,800	45,100	2·53	2·92
June	49,900	45,700	47,800	2·68	2·99
July	51,400	44,400	48,600	2·73	3·15
Aug.	44,400	30,000	37,100	2·08	2·40
Sept.	29,000	15,500	21,100	1·19	1·33
Oct.	15,300	12,400	13,400	0·75	0·87
Nov.	13,700	11,200	12,700	0·71	0·79
Dec.	11,200	8,880	9,970	0·56	0·65
Year	51,400	7,000	23,313	1·31	17·87

[1] Summary for Sept. to Dec., 1914, is from the record for Kootenay river at Bonnington pool, which has practically the same discharge, no large streams entering between the two stations.

64—KOOTENAY RIVER—near Nelson

Drainage area, 17,700 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Astley wharf, Nelson, about 2 miles above the outlet of the West arm of Kootenay lake.

Records available—Jan., 1913, to Dec., 1915.

* Possibly nearly 18,000 square miles, if account is taken of changes on recent maps.

Gauge—Vertical staff 20 feet long, situated at Astley wharf; read daily.

Discharge measurements—None have been made at this station.

Winter flow—The river below the lake seldom, if ever, freezes. The main lake never freezes and the West arm only freezes occasionally

Accuracy—As in the case of the Kootenay river at Bonnington falls, discharges based upon the Nelson gauge are determined by subtracting the discharge of Slocan river from discharge of Kootenay river near Glade. To compensate for the inflow to Kootenay river below the outlet of the lake and above Glade (excluding Slocan river), the discharge thus determined is further reduced by 1 per cent. Recent measurements suggest the possibility of error in the rating curve used for the Slocan river. (See note under that stream.) This error will be reflected in the rating of the Kootenay river at Bonnington falls and Nelson, though to a reduced degree, as the Slocan discharge forms but a small proportion of the flow of the Kootenay river at Glade. The mean monthly discharges given below should be within 10 or 15 per cent.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1913					
Jan.	....	....	....	....	....	Jan.	8,300	[illegible]	7,020	0·40	0·46
Feb.	....	....	....	....	....	Feb.	6,550	6,270	6,360	0·36	0·38
Mar.	....	....	....	....	....	Mar.	7,780	6,350	6,750	0·38	0·44
April	....	....	....	....	....	April	31,500	8,250	17,900	1·01	1·13
May	....	....	....	....	....	May	80,300	30,400	43,500	2·46	2·84
June	....	....	....	....	....	June	134,000	86,300	115,000	6·50	7·25
July	....	....	....	....	....	July	96,100	48,300	69,700	3·94	4·54
Aug.	....	....	....	....	....	Aug.	47,000	29,800	37,500	2·12	2·44
Sept.	....	....	....	....	....	Sept.	29,300	20,700	26,000	1·47	1·64
Oct.	....	....	....	....	....	Oct.	20,700	15,400	17,500	0·99	1·14
Nov.	....	....	....	....	....	Nov.	14,900	11,200	12,600	0·71	0·79
Dec.	....	....	....	....	....	Dec.	11,100	8,050	9,730	0·55	0·63
Year	....	....	....	....	....	Year	134,000	6,270	30,797	1·74	23·68
1914						1915					
Jan.	11,800	8,050	10,200	0·58	0·67	Jan.	10,100	7,810	9,130	0·52	0·60
Feb.	9,700	7,150	7,730	0·44	0·46	Feb.	7,810	7,380	7,540	0·43	0·45
Mar.	11,400	7,450	9,010	0·51	0·59	Mar.	9,770	7,230	7,920	0·45	0·52
April	35,500	10,900	21,900	1·24	1·38	April	34,400	9,940	20,900	1·18	1·32
May	78,400	36,100	60,100	3·40	3·92	May	49,500	35,300	45,000	2·54	2·93
June	89,200	76,700	84,100	4·75	5·30	June	49,500	45,400	47,800	2·70	3·01
July	82,400	51,900	73,900	4·18	4·82	July	51,700	43,900	48,300	2·73	3·15
Aug.	50,500	24,600	34,000	1·92	2·21	Aug.	43,600	29,800	36,500	2·06	2·28
Sept.	24,100	18,300	20,000	1·13	1·26	Sept.	28,900	15,900	21,400	1·21	1·35
Oct.	18,900	16,800	17,700	1·00	1·15	Oct.	15,600	12,000	13,500	0·76	0·88
Nov.	22,600	17,300	20,500	1·16	1·29	Nov.	13,700	11,600	12,900	0·73	0·81
Dec.	18,000	9,300	12,500	0·71	0·82	Dec.	11,200	9,050	9,910	0·56	0·65
Year	89,200	7,150	30,970	1·75	23·87	Year	51,700	7,230	23,400	1·32	05

65—KOOTENAY RIVER—near Wardner — Drainage area, 5,200 square miles

DESCRIPTION OF GAUGING STATION

Location—At the highway bridge, near Wardner, above Elk river and below Bull and St. Marys rivers ; about 35 miles from the international boundary.

Records available—Jan. to Dec., 1914 ; Mar. to Dec., 1915 ; Mar. to Dec., 1916.

Gauge—A vertical staff gauge, 12 feet long ; read daily (twice daily in 1916).

Channel—The channel is straight and uniform, but piles have been driven down the centre of the river for logging purposes.

Discharge measurements—Are made from the traffic bridge.

Winter flow—The river is generally affected by ice from December to March ; frazil ice occurs.

Accuracy—Rating curve is good ; results should be within 5 or 10 per cent.

General—The fall of the river is very gradual, and there are no power sites between Canal Flats and Wardner. The river is most suitable for logging and, each year, large drives come down from its headwaters.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					Oct. 13	2,460	2·11	2·88	5,180
Nov. 23	2,100	1·64	2·00	3,460	Dec. 13	774	2·11	1·7	1,637[1]
1914					1915				
May 19	4,860	4·83	8·00	23,500	Feb. 23	927	1·95	1·10	1,810[1]
June 7	4,840	4·85	8·00	23,500	April 27	2,720	2·74	3·80	7,400
" 15	5,450	5·55	9·30	30,200	May 29	3,600	4·11	5·90	14,800
" 20	6,070	6·41	10·65	38,900	June 16	3,460	3·82	5·60	13,200
July 25	3,350	3·38	5·00	11,500	Aug. 29	2,690	2·56	3·60	6,870
" 31	3,210	3·33	4·70	10,700	1916				
Oct. 7	2,490	2·08	2·95	5,210	Sept. 9	3,000	3·06	4·38	9,170
					Oct. 5	2,270	1·85	2·54	4,200

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Jan	......	......	......	....	....
Feb.	......	......	......	....	....
Mar	......	......	......	....	....
April	......	......	......	....	....
May	......	......	......	....	....
June	......	......	......	....	....
July	......	......	......	....	....
Aug.	......	......	......	....	....
Sept.	......	......	......	....	....
Oct.	......	......	......	....	....
Nov.	......	......	......	....	....
Dec.	......	......	......	....	....
Year	......	......	......	....	....
1915					
Mar.	2,610	1,500	1,870	0·36	0·42
April	12,000	2,210	6,340	1·22	1·36
May	16,800	[illegible],750	12,400	2·38	2·74
June	21,800	11,200	14,800	2·85	3·18
July	19,000	11,900	14,900	2·87	3·31
Aug.	12,300	7,040	9,120	1·76	2·03
Sept.	7,200	4,240	5,090	0·97	1·08
Oct.	5,060	3,560	4,130	0·79	0·91
Nov.	4,940	2,880	3,640	0·70	0·78
Dec.	2,750	2,160	2,540	0·49	0·57
Period	21,800	1,500	7,480	1·4[1]	16·38
1914					
Jan.[1]	1,200	600	1,100	0·21	0·24
Feb.[1]	1,700	800	1,420	0·27	0·28
Mar.	1,000	600	852	0·16	0·18
April	8,400	800	4,920	0·95	1·06
May	25,300	8,700	18,100	3·48	4·01
June	43,300	17,400	26,400	5·08	5·67
July	30,200	10,500	19,100	3·67	4·23
Aug.	11,000	5,640	7,820	1·50	1·73
Sept.	7,410	4,400	5,620	1·08	1·20
Oct.	6,400	4,700	5,510	1·06	1·22
Nov.	6,700	3,540	4,750	0·91	1·02
Dec.	3,350	840	1,940	0·37	0·43
Year	43,000	500	8,128	1·56	21·27
1916					
Mar.	....	....	....	....	....
April	8,400	2,300	4,260	0·82	0·92
May	17,300	7,800	11,300	2·17	2·50
June	67,500	13,200	33,800	6·50	7·25
July	39,500	13,400	27,400	5·27	6·08
Aug.	14,400	8,700	10,700	2·06	2·38
Sept.	11,600	5,180	7,490	1·44	1·61
Oct.	4,890	3,250	3,890	0·75	0·86
Nov.	3,400	1,720	2,640	0·51	0·57
Dec.	2,840	2,040	2,290	0·44	0·51
Period	67,500	1,720	11,530	2·22	22·68

[1] Partly estimated.

66—LILLOOET RIVER—at Agerton

Drainage area, 800 square miles

DESCRIPTION OF GAUGING STATION

Location—Government highway bridge at Agerton, 8 miles above Lillooet lake and 2 miles above the mouth of Green river.

Records available—Nov. 16, 1913, to Dec. 31, 1916.

Drainage area—Above mouth, is 2,200 sq. miles; above lower end of Lillooet lake, 1,600 sq. miles; above upper end of lake, 1,300 sq. miles; above gauging station, 800 sq. miles.

Gauge—Vertical staff nailed to central pier of bridge; read daily.

Channel—Wide and deep; smooth, sandy bed. An excellent measuring section.

Discharge measurements—Rating curve is well defined for all stages.

Winter flow—Stream is sometimes frozen over in winter.

Accuracy—B below discharge of 5,000 sec.-ft. and D above. Change in control Aug. 20, 1915, necessitated revision of rating curve. Monthly summaries as given below embody recent revisions.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					May 24	1,527	3·38	5·35	5,170
Nov 16	645	2·63	1·83	1,693[1]	June 13	1,753	4·26	7·35	7,580
1914					Aug. 4	2,220	5·10	8·60	11,300
Mar 28	636	2·42	1·97	1,540	Dec. 1	444	2·00	1·50	886
May 31	1,380	3·54	4·92	4,880	1916				
June 28	2,063	4·37	7·60	9,000	April 27	900	2·69	3·47	2,420
Aug 10	1,831	4·00	6·76	7,400	May 10	1,090	2·64	4·02	2,880
July 15	2,692	6·15	10·4	16,500	June 9	1,629	3·56	6·35	5,800
1915					Sept. 21	1,620	3·51	6·30	5,680
Feb. 8	460	1·73	2·08	778[2]	Dec. 7	368	1·56	1·48	575
" 22	366	1·95	1·00	712					

[1] Station established. [2] Ice cover.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
							1914				
Jan.	....	....	....	....	....	Jan.[1]	1,400	....	1,130	1·41	1·62
Feb.	....	....	....	....	....	Feb.[1]	....	....	700	0·88	0·92
Mar.	....	....	....	....	....	Mar.	2,670	700	1,700	2·12	2·44
April	....	....	....	....	....	April	3,750	1,700	2,860	3·58	3·99
May	....	....	....	....	....	May	9,250	3,750	5,870	7·34	8·46
June	....	....	....	....	....	June	16,500	4,930	9,140	11·42	12·74
July	....	....	....	....	....	July	18,300	6,800	13,010	16·25	19·98
Aug.	....	....	....	....	....	Aug.	14,700	7,500	10,560	13·20	15·22
Sept.	....	....	....	....	....	Sept.	7,850	3,200	5,030	6·29	7·02
Oct.	....	....	....	....	....	Oct.	19,200	2,670	6,590	8·24	9·50
Nov.	....	....	....	....	....	Nov.	4,030	2,470	3,540	4·42	4·93
Dec.	....	....	....	....	....	Dec.	3,200	1,400	1,840	2·30	2·65
Year	....	....	....	....	....	Year	19,200	700	5,164	6·4[illegible]	89·47
	1915						1916				
Jan.[1]	2,470	700	1,310	1·64	1·89	Jan.[1]	....	....	600	0·7[illegible]	0·86
Feb.[1]	900	700	730	0·91	0·95	Feb.[1]	....	....	683	0·[illegible]5	0·92
Mar.	2,670	900	1,660	2·08	2·40	Mar.[1]	2,940	....	1,5[illegible]	[illegible]·91	2·20
April	5,050	2,670	3,550	4·44	4·95	April	2,720	1,540	2,200	2·75	3·07
May	7,850	2,770	5,180	6·48	7·47	May	6,510	2,940	4,370	5·46	6·30
June	12,520	4,930	8,470	10·60	11·83	June	16,100	5,480	10,200	12·80	14·30
July	19,200	7,850	13,200	16·50	19·00	July	13,500	6,680	9,980	12·50	14·40
Aug.	19,200	8,590	13,200	16·50	19·00	Aug.	14,100	5,760	10,400	13·00	15·00
Sept.	11,700	3,160	5,430	6·79	7·58	Sept.	11,000	3,380	6,440	8·05	8·98
Oct.	6,510	1,000	2,420	3·02	3·48	Oct.	5,760	1,540	2,600	3·25	3·75
Nov.	2,400	680	1,090	1·36	1·52	Nov.	1,540	600	1,000	1·25	1·40
Dec.[1]	1,000	....	690	0·86	0·99	Dec.[1]	600	....	546	0·68	0·78
Year	19,200	....	4,744	5·93	81·06	Year	16,100	....	4,210	5·27	71·96

[1] Gauge height-discharge relation affected by ice and discharge estimated as follows: 1914, Jan. 26 to Feb. 21, 700 sec. ft.; 1915, Jan. 25 to Feb. 12, 700 sec. ft., and Dec. 25 to 31, 600 sec. ft.; 1916, Jan. 1 to Feb. 13, 600 sec. ft.; Feb. 14 to 21, 70[illegible] sec. ft.; Feb. 22 to 29, 800 sec. ft.; Mar. 1 to 7, [illegible]00 sec. ft.; Dec. 24 to 31, 520 sec. ft.

67—LITTLE QUALICUM RIVER—at Cameron lake outlet — Drainage area, 60 square miles*

DESCRIPTION OF GAUGING STATION

Location—At outlet of Cameron lake, downstream side of highway bridge.

Records available—Feb 27 to Dec. 31, 1913, Provincial Water Rights Branch; Jan. 1, 1914, to Dec. 31, 1916, B. C. Hydrometric Survey.

Gauge—12-foot wooden staff nailed to crib on shore of lake, 500 feet from head of river; read twice daily.

Channel—Straight on both sides of section for 100 feet, gravel and small boulder bed, one channel at all stages, confined by bridge abutments in high water.

Discharge measurements—6 in 1913 by Provincial Water Rights Branch and 9 in 1914, 1915 and 1916 by B. C. Hydrometric Survey.

Winter flow—Open all winter.

Accuracy—A up to 600 sec.-ft.; B, 600 to 1,000 sec.-ft.; C, above 1,000 sec.-ft. Monthly summaries given below for 1913 and 1914 embody revisions based on later measurements, see NOTE, page 309.

* Revised value based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
Feb. 27	91	2·35	1·87	214[1]
Sept. 23	43	1·64	0·82	70·6
Nov. 18	197	3·24	3·80	638
Dec. 4	178	3·12	3·27	555
" 15	188	3·15	3·56	592
" 29	98	2·06	1·79	202
1914				
May 20	143	2·4	2·40	340[2]
July 10	80	1·9	1·40	119
Sept. 1	33	1·1	0·49	35·3
" 2	32	1·0	0·47	33·5
Dec. 16	116	2·3	2·05	269
1915				
April 16	160	2·73	2·80	437
Sept. 5	33	0·94	0·39	31
1916				
Mar. 20	157	2·53	2·83	397
Oct. 30	57	1·84	1·05	105

[1] Metered at bridge opposite Chalet. [2] New station established by B. C. Hydrometric Survey. No change in gauge datum.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	210	156	172	2·87	3·31
April	432	141	267	4·45	4·95
May	602	212	363	6·05	6·98
June	530	319	387	6·45	7·19
July	367	132	259	4·32	4·97
Aug.	125	56	76	1·27	1·46
Sept.	180	58	116	1·93	2·15
Oct.	630	110	263	4·38	5·05
Nov.	1,480	131	543	9·05	10·10
Dec.	800	215	426	7·10	8·17
Period	1,480	56	287	4·78	54·31
1915					
Jan.	465	150	272	4·53	5·22
Feb.	330	165	245	4·08	4·25
Mar.	700	170	344	5·73	6·60
April	1,030	200	465	7·75	8·65
May	295	185	218	3·63	4·19
June	185	70	124	2·07	2·31
July	70	47	57	0·95	1·09
Aug.	47	30	37	0·62	0·71
Sept.	37	28	31	0·52	0·58
Oct.	1,530	30	290	4·83	5·56
Nov.	[illegible]	185	334	5·57	6·21
Dec.	710	[illegible]	485	8·08	9·31
Year	1,530	28	242	4·03	54·68

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	1,910	215	632	10·53	[illegible]
Feb.	535	165	242	4·03	[illegible]
Mar.	855	290	498	8·30	[illegible]·19
April	840	255	495	8·25	9·57
May	445	315	382	6·37	9·21
June	375	235	278	4·63	7·33
July	230	68	134	2·23	5·15
Aug.	68	45	54	0·90	2·57
Sept.	192	38	91	1·52	1·04
Oct.	2,030	150	655	10·92	1·70
Nov.	1,300	375	824	13·73	12·57
Dec.	650	130	259	4·32	15·33
					4·97
Year	2,030	38	379	6·31	85·76
1916					
Jan.	325	116	165	2·75	3·17
Feb.	1,120	115	374	6·23	6·72
Mar.	1,060	291	500	8·33	9·60
April	445	315	370	6·17	6·88
May	575	353	438	7·30	8·41
June	760	400	508	8·47	9·45
July	462	229	335	5·58	6·43
Aug.	209	82	133	2·22	2·56
Sept.	76	43	59	0·98	1·09
Oct.	176	35	47	0·78	0·90
Nov.	341	105	[illegible]	3·35	3·73
Dec.	243	[illegible]	[illegible]	2·92	3·27
Year	1,126	35	276	[illegible]·60	62·31

68—LOUIS CREEK—12 miles from mouth

Drainage area, 100 square miles

DESCRIPTION OF GAUGING STATION

Location—2 miles south of the Railway Belt boundary, about 12 miles from mouth. Sec. 33, tp. 23, rge. 15, W. 6th mer.

Records available—Aug. 16 to Oct. 31, 1911 ; April 1 to Nov. 16, 1912 ; May 1 to Oct. 14, 1913; April 1 to Dec. 11, 1914 ; April 1 to Sept. 30, 1915 ; April 1 to Nov. 17, 1916.

Gauge—Standard vertical staff ; read daily during high water and two or three times weekly during low water.

Channel—Width averages 25 to 35 ft. at measuring section ; channel at control is affected by gradual scour.

Discharge measurements—Are made by wading or from the bridge.

Winter flow—Ice conditions obtain during winter months.

Accuracy—Fair, somewhat impaired by shifting channel; results, however, should be within 10 to 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Aug. 16	33·4	0·80	0·91	28
Sept. 18	36·8	0·96	0·98	35·4
1912				
April 30	49·4	1·7	1·50	94
May 16	108·2	4·0	3·80	439
" 29	90	3·6	3·20	328
June 8	82	3·4	2·72	276
" 9	85	3·4	2·81	288
Aug. 22	19	2·8	1·02	52[1]
1913				
June 28	58	2·65	2·10	155
1914				
Aug. 13	27·3	1·0	0·59	28
1915				
April 15	22	2·3	0·82	51
May 13	58	2·9	1·82	168
1916				
May 15	51·1	2·14	1·29	109
July 21	58·2	2·02	1·40	117
Aug. 31	36·2	0·65	0·58	23

[1] Different section.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
April	...	...	...	...	...
May	...	...	...	...	...
June	...	...	...	...	...
July	...	...	...	...	...
Aug.	...	...	...	...	...
Sept.	48	14	28·3	0·28	0·31
Oct.[1]	24	14	17·6	0·18	0·21
1912					
April	94	34	47·6	0·48	0·53
May	520	94	312	3·12	3·59
June	301	94	207	2·07	2·31
July	133	57	89·3	0 89	1·02
Aug.	84	50	57·5	0·57	0·66
Sept.	81	45	57·6	0·58	0·65
Oct.	55	43	46·4	0·46	0·53
1913					
April	...	...	...	...	...
May	398	50	172	1·72	1·98
June	454	144	250	2·50	2·79
July	165	57	98	0·98	1·13
Aug.	65	42	54	0·54	0·62
Sept.	48	38	42	0·42	0·47
Oct.	...	...	...	...	...
Nov.	...	...	...	...	...
Period	454	38	123	1·23	6·99
1914					
April	61	26	43	0·43	0·48
May	398	89	233	2·33	2·69
June	326	130	226	2·26	2·52
July	117	30	66	0·66	0·76
Aug.	30	22	25	0·25	0·29
Sept.	28	20	24	0·24	0·27
Oct.	28	24	25	0·25	0·29
Nov.	32	24	26	0·26	0·29
Period	398	20	84	0 84	7·59
1915					
April	105	15	57	0·57	0·64
May	375	96	213	2·13	2·46
June	360	81	132	1·32	1·47
July	240	81	119	1·19	1·37
Aug.	91	29	47	0·47	0·55
Sept.	45	29	32	0·32	0·36
Oct.	...	...	...	...	...
Period	375	15	100	1·00	6·85
1916					
April	93	16	27	0·27	0·30
May	260	105	175	1·75	2·02
June	385	230	285	2·85	3·18
July	350	72	155	1·55	1·79
Aug.	72	25	45	0·45	0·52
Sept.	27	19	24	0·24	0·27
Oct.	19	19	19	0·19	0·22
Period	385	16	104	1·04	8·30

69—LYNN CREEK—4 miles from mouth

Drainage area, 14 square miles*

DESCRIPTION OF GAUGING STATION

Location—Below the overflow from North Vancouver intake, and about 4 miles from the mouth.

Records available—June 10, 1914, to Dec. 31, 1916.

Co-operation—Gauge readings by the Water Works Dept. of North Vancouver.

Gauge—Cable gauge on flume bridge; read twice daily.

Channel—Boulders and solid rock.

Discharge measurements—Well define the rating curve.

Winter flow—Open water all year.

Accuracy—C and B.

General—This stream furnishes the water supply to the municipality oı North Vancouver.

* Revised estimate by engineers of the Provincial Water Rights Branch. In 1913, drainag e area was estimated to be 17 sq. miles.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
					1915				
1909					April 9	70·1	2·30	5·52	165
Aug. 4	....	....	....	57 [1]	June 1	56·9	1·56	5·00	88·7
1913					" 24	20·2	0·90	4·12	18
Nov. 3	38	1·5	1·73	58·5	Aug. 3	14·2	0·45	3·85	6·5
1914					" 13	11·2	0·30	3·48	3·2
June 10	54	2·40	5·00	124	1916				
" 17	60	2·30	5·12	135	April 18	104	2·66	6·00	277
Aug. 18	9·4	0·20	3·45	2·2	June 16	129	3·84	6·65	495
Oct. 21	91	2·82	5·80	250	Sept 13	15·2	0·73	4·12	11·1

[1] Not referred to gauge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1914					
July	....	....	....	....	....	July	130	2	47	3·36	3·86
Aug.	....	....	....	....	....	Aug.	30	1	3	0·24	0·28
Sept.	....	....	....	....	....	Sept.	430	1	145	10·36	11·56
Oct.	....	....	....	....	....	Oct.	560	34	164	11·72	13·51
Nov.	....	....	....	....	....	Nov.	660	155	315	22·50	25·11
Dec.	....	....	....	....	....	Dec.	285	10	85	6·07	6·99
Period	....	....	....	....	....	Period	660	1	126	9·00	61·31
1915						1916					
Jan.	270	13	115	8·21	9·46	Jan.	250	1	108	7·71	8·89
Feb.	243	57	169	12·07	12·57	Feb.	1,290	1	233	16·60	17·90
Mar.	305	41	151	10·78	12·43	Mar.	1,110	107	557	39·80	45·90
April	1,200	77	193	13·78	15·38	April	745	215	360	25·70	28·70
May	395	49	203	14·50	16·72	May	435	250	292	20·90	24·10
June	165	9	56	4·00	4·46	June	505	250	343	24·50	27·30
July	41	2	12·9	0·92	1·06	July	625	165	351	25·10	28·90
Aug.	6	0	2	0·14	0·16	Aug.	488	40	160	11·40	13·10
Sept.	9	0	1·2	0·09	0·10	Sept.	75	3	20	1·43	1·60
Oct.	765	9	221	15·80	18·22	Oct.	905	5	83	5·93	6·84
Nov.	562	120	222	15·90	17·70	Nov.	525	75	191	13·60	15·20
Dec.	810	50	277	19·80	22·80	Dec.	100	12	54	3·86	4·45
Year	1,200	0	135	9·65	131·06	Year	1,200	1	230	16·40	222·88

70—**MARK CREEK**—near mouth

Drainage area, 54 square miles*

DESCRIPTION OF GAUGING STATION

Location—At mouth of creek near Marysville, about 14 miles from Cranbrook.

Records available—May to Dec., 1914 ; April to Nov., 1915 ; Jan. to Dec., 1916.

Co-operation—This station was maintained by co-operation between the B. C. Hydrometric Survey and the Provincial Water Rights Branch during 1914.

Gauge—An enamel gauge, 6 feet long ; read daily.

Channel—Straight and rocky, water is generally broken. Control changed June, 1916.

Discharge measurements—Thirteen, up to June, 1916, well define rating curve. For latter part of 1916, rating curve is based on 6 measurements.

Winter flow—The creek freezes over in November or December, and remains frozen till March. Frazil ice forms.

Accuracy—Results from first rating curve B ; from second, C.

General—Creek partially developed for power for mining operations.

* Not well defined on existing maps; this is a revised estimate based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					May 26	44·4	3·08	2·18	137
May 1	41·4	2·66	1·68	110	June 13	39·7	2·43	2·00	96·3
" 28	57·9	4·08	2·2	236	Aug. 26	29·5	0·81	1·16	26·4
July 3	55·4	4·02	2·1	223	1916				
" 24	34·1	1·92	1·4	56·4	Mar. 4	21·0	0·61	Ice	12·9
Sept. 1	22·2	0·77	1·00	17·2	June 17	88·8	0·10	3·70	808·0
" 29	26·2	1·05	1·20	27·4	July 7	49·6	5·39	1·75	268·0[2]
Oct. 10	28·4	0·86	1·12	24·2	" 26	34·2	2·85	1·05	97·4
" 16	20·4	0·99	1·22	29·1	Aug. 15	16·8	1·97	0·75	33·1
1915					Sept. 15	14·9	1·36	0·59	20·2
Feb. 21	23·0	0·48	1·25	11[1]	Oct. 7	13·9	1·29	0·55	17·9
April 22	41·5	2·83	2·10	118	Dec. 4	17·1	1·12	0·50	19·3

[1] Ice conditions. [2] New rating curve.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile[3]	
						1914					
May	......	......	......	......	......	May	368	122	238	4·41	5·08
June	......	......	......	......	......	June	527	132	270	5·00	5·57
July	......	......	......	......	......	July	221	36·8	105	1·95	2·25
Aug.	......	......	......	......	......	Aug	38·1	17·9	23·4	0·43	0·50
Sept.	......	......	......	......	......	Sept	28·1	15·8	21·0	0·39	0·43
Oct.	......	......	......	......	......	Oct	34·1	21·8	27·4	0·51	0·59
Nov.	......	......	......	......	......	Nov	38·1	24·5	28·9	0·54	0·60
Dec.	......	......	......	......	......	Dec.[1]	36·8	......	20·1	0·37	0·43
1915						1916					
Jan.	......	......	......	......	......	Jan.	191	10	24	0·44	0·51
Feb.	......	......	......	......	......	Feb.	15	10	13	0·24	0·26
Mar.	......	......	......	......	......	Mar.	18	15	16	0·30	0·35
April	160	23·5	78·2	1·45	1·62	April	108	18	61	1·13	1·26
May	191	102	135·0	2·50	2·88	May	246	57	140	2·60	3·00
June	170	78·2	112·0	2·08	2·32	June	......	......	......	......	......
July	78·2	37·7	58·3	1·08	1·24	July[3]	......	......	......	......	......
Aug.	51·5	18·6	27·4	0·51	0·59	Aug.	57	21	35	0·65	0·75
Sept.	28·2	16·6	21·0	0·39	0·43	Sept.	26	16	19	0·35	0·39
Oct.	29·1	17·6	21·8	0·40	0·46	Oct.	21	16	17	0·32	0·37
Nov.	22·1	15·8	17·9	0·33	0·37	Nov.	33	11	17	0·32	0·36
Dec.[2]	......	......	......	......	......	Dec.	16	13	15	0·28	0·32

[1] Stream frozen after Dec. 15, discharge estimated. [2] Ice conditions obtained after Dec. 24. [3] Gauge washed out June 16, not replaced until July 7.

71—MATHER (CHERRY) CREEK—near mouth

Drainage area, 80 square miles

DESCRIPTION OF GAUGING STATION

Location—About 1 mile above the mouth, near Wasa, East Kootenay.

Records available—May to Nov., 1913; April 15 to Oct. 8, 1914; April 11 to Sept. 30, 1915; June 15 to Oct. 1, 1916.

Co-operation—During 1914, this station was maintained by co-operation between the Provincial Water Rights Branch and the B. C. Hydrometric Survey.

Gauge—Vertical staff; read daily. (Up to 1915 was recorded in feet and inches.)

Channel—Channel is regular and affords a good measuring section; slight shifts are possible owing to silty nature of bed.

Discharge measurements—The 1914 rating curve was based largely on the five discharge measurements in 1914. The measurements made in 1913, after June 30, conform to this 1914 curve. In estimating discharges for 1913, the 1914 rating curve was used for period after June 30. The estimates for May and June, 1913, are deduced from a rating curve based on measurements made by the District Engineer, Provincial Water Rights Branch. In 1915 and 1916 new curves were used.

Accuracy—Fair.

General—This stream is used for irrigation.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912				
May 5	19·7	3·83	....	75·4 [1]
1913				
May 29	37·5	7·27	....	272·3
June 3	40 3	8·35	....	336·7
" 23	25·8	4·96	....	128·5
July 28	18 5	2·14	0·42	39·7
Sept. 24	16·5	1·42	0·29	23·5
Oct. 14	17·0	1·45	0·32	24·6
1914				
May 28	32·8	4·61	1·133	1·52
July 15	30·2	3·05	0·958	92·2
" 24	21·2	2·34	0·604	56·7
Aug. 31	13·7	1·18	0·062	16·2
Sept. 25	16·3	1·37	0·229	22·3
1915				
April 22	29·2	2 88	0·792	84·1
May 26	29·8	3·43	0·916	102
June 12	29·8	3·46	0·896	103
Aug. 25	16·7	1·53	0·242	26 5
1916				
June 18	74·0	8·26	3·11	610
July 7	38·5	5·90	1·77	227
" 26	27·0	4·13	0·86	112
Aug. 16	18·3	2·82	0·53	52
Sept. 15	13·9	2·41	0·32	335
Oct. 4	15·2	1·96	0·37	30

[1] At waggon bridge; one mile above mouth.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
May [1]	300	....	145·0	1·81	2·09
June	370	109	230·0	2·87	3·20
July	131	35	70·6	0·88	1·02
Aug.	34	30	30 5	0·38	0·44
Sept.	30	24	25 1	0·31	0·35
Oct.	27	18	23·5	0·29	0 33
Nov. [2]	20	....	17·9	0·22	0·24
1915					
May	120	78	96·5	1·21	1·39
June	124	67	97·1	1·21	1·35
July	97	57	76·2	0·95	1·10
Aug.	54	17	32·1	0·40	0·46
Sept.	30	17	24·6	0·31	0 35
1914					
May	183	100	143·0	1·79	2·06
June	312	97	176·0	2·20	2·46
July	124	35	68·7	0 86	0·99
Aug.	24	16	20 9	0·26	0·30
Sept.	34	14	21·5	0·27	0·30
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
1916					
May	....	....	....	....	....
June	....	....	....	....	....
July [3]	561	64	224 0	2·80	3·23
Aug.	79	39	59 8	0 75	0·86
Sept.	44	21	33·4	0 42	0·47

[1] Estimated May 1 to 5. [2] Estimated Nov. 21-30. [3] Owing to difficulty in securing a gauge reader no records re available before June 18.

MESLILOET (INDIAN) RIVER AND TRIBUTARIES

For convenience, data on these streams are grouped together, as such data have been gathered in connection with one proposed power development.

72—MESLILOET RIVER—8 miles from mouth* | Drainage area, 65 square miles †

DESCRIPTION OF GAUGING STATION

Location—A short distance below cañon, 8 miles from mouth, and in sec. 8, tp. 7, rge. 7, W. 7th mer.

Records available—Oct. 31, 1912, to Dec. 31, 1916.

Co-operation—Gauge readers are maintained by the Westminister Pow Co.

Drainage area—Estimated at from 45 to 65 sq. miles.†

Gauge—Vertical staff; read two or three times a week.

Channel—Boulders and gravel; permanent control.

Discharge measurements—Well define the rating curve.

Winter flow—Open water conditions all winter.

Accuracy—B and C. Infrequency of gauge readings impairs accuracy.

* In 1912, a gauging station was maintained from March to December at the mouth of the Mesliloet river. This station was superseded by the one at the present site close to the cañon, which latter gives a record of the flow available at the proposed intake location.

† The watershed is not well defined on existing maps; the estimate of 65 sq. miles, made by the B.C. Hydrometric Survey, and used below in computing the run-off per sq. mile, may, possibly, be too great.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912					Nov. 16	277	3·5	3·58	942
Oct. 31	120	1·6	2·26	188 [1]	1914				
1913					Aug. 2	131	1·2	2·00	154
June 6	232	2·9	3·25	662	Nov. 11	220	2·6	3·05	555
" 13	240	3·1	3·40	713	1915				
" 17	195	2·4	2·90	446	May 6	205	2·30	2·85	476
July 3	213	2·4	2·98	471	July 16	157	1·31	2·15	205
" 29	146	1·6	2·28	230	" 17	159	1·19	2·05	174
Sept. 17	109	1·2	1·87	122	1916				
Oct. 9	81	0·9	1·61	76	Oct. 12	63	0·75	1·30	47·5 [2]
Nov. 10	186	2·2	2·86	417					

[1] Station established. [2] Wading.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
						1912					
Nov....	....	....	....	....	....	Nov....	1,720	160	599	9·2	10·3
Dec....	....	....	....	....	....	Dec....	1,510	136	246	3·8	4·4
1913						1914					
Jan.....	147	60	78	1·2	1·38	Jan....	3,320	116	597	9·2	10·6
Feb.....	1,720	50	283	4·4	4·58	Feb....	413	72	162	2·5	2·6
Mar.....	222	72	131	2·0	2·31	Mar....	1,010	170	360	5·5	6·3
April....	690	89	337	5·2	5·80	April...	1,115	170	480	7·1	7·9
May....	1,370	180	645	9·9	11·53	May...	1,150	280	520	8·0	9·2
June....	1,290	436	716	11·0	12·27	June...	755	251	393	6·0	6·7
July....	1,110	185	449	6·9	8·07	July...	295	136	228	3·5	4·0
Aug.....	368	105	188	2·9	3·46	Aug....	147	50	99	1·5	1·7
Sept.....	485	89	214	3·3	3·68	Sept....	1,880	50	447	6·9	7·7
Oct.....	2,120	72	293	4·5	5·18	Oct....	1,800	115	644	9·9	11·4
Nov.....	1,880	98	594	9·1	10·15	Nov....	1,600	170	691	10·6	11·8
Dec.....	755	115	269	4·1	4·72	Dec....	370	60	121	1·9	2·2
Year....	2,120	50	350	5·4	73·10	Year...	1,880	50	394	6·06	82·1
1915						1916					
Jan.....	1,290	70	286	4·40	5·07	Jan....	485	70	139	2·14	2·47
Feb.....	390	135	226	3·48	3·62	Feb....	2,680	60	779	12·00	12·90
Mar.....	1,650	160	455	7·00	8·07	Mar....	1,010	195	563	8·66	9·98
April....	2,680	220	677	10·40	11·60	April...	1,080	345	530	8·15	9·09
May....	485	115	318	4·89	5·64	May...	860	390	610	9·38	10·80
June....	390	160	245	3·77	4·21	June...	1,440	485	790	12·20	13·60
July....	207	113	164	2·52	2·91	July...	1,370	390	701	10·80	12·50
Aug.....	113	35	94	1·45	1·67	Aug....	485	170	291	4·48	5·17
Sept.....	220	42	78	1·20	1·34	Sept....	180	80	112	1·72	1·92
Oct.....	2,680	50	951	14·63	17·18	Oct....	440	40	89	1·37	1·58
Nov.....	1,510	145	422	6·50	7·25	Nov....	860	105	370	5·69	6·35
Dec.....	2,520	125	740	11·38	13·95	Dec....	550	60	134	2·06	2·38
Year....	2,680	35	388	5·97	82·51	Year...	2,680	40	426	6·55	88·74

MESLILOET RIVER TRIBUTARIES

In connection with its proposed development on the Mesliloet river and tributaries, the Westminster Power Co., in conjunction with the British Columbia Hydrometric Survey, has made a study of the flow of the streams involved.

Considerations of space preclude the giving of records for many of the smaller and less important streams of the province—that is, viewed from the standpoint of power development. Inasmuch, however, as there are comparatively little data for the smaller coastal streams, and as such data are of special interest in connection with power development, it is desirable here to present a summary of the existent data for the tributaries of the Mesliloet river.

Description of Stations—Generally speaking these creeks are mountain streams, with rocky, boulder-strewn beds. The drainage areas are small, but not definitely known. The channel at most of the stations is rough, but with permanent control. Vertical staff gauges are used in each case. They are read irregularly and, owing to the flashy nature of the creeks, the gauge readings do not adequately record extremes of, or rapid changes in, stage. The gauge at Brandt creek, near mouth, is generally read 5 or 6 times a week, but the other gauges only from 1 to 3 times per week. Except under very exceptional conditions, the streams remain open throughout the winter, although the lakes freeze over. The rating curves are well defined.

Data Presented—The data here given comprise for each station : (1) The maximum daily discharge recorded during the period of record for each month of the year. (2) The mean monthly discharge for each month in the period. (3) The minimum daily discharge recorded during the period for each month of the year. *Note* : Owing to the infrequency of the gauge readings, it is probable that the real maximum and minimum discharges were, respectively, greater and smaller than those actually recorded.

72a—BELKNAP CREEK—at outlet from Belknap lake. Records available : Oct., 1912, to Dec., 1916.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge.....	49	430	390	280	222	430	280	170	630	610	510	300	....
Mean monthly discharge, 1912.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48		....
do 1913.	8	14	11	38	82	174	137	54	54	81	40	33	61
do 1914.	.....	12	39	63	143	113	97	38	159	136	130	16	86
do 1915.	21	27	92	155	129	77	59	17	20	222	179	144	95
do 1916.	17	93	80	74	136	266	201	115	60	26	212	71	113
Minimum daily discharge.....	8	8	9	9	25	40	33	15	9	11	13	8	....

72b—BELKNAP CREEK—below Ann lake, about half way between Ann lake and Belknap lake near the proposed site for the diversion dam. Records available : June, 1914, to Dec., 1916, also 3 meter measurements in 1913.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge.....	46	402	310	210	173	415	251	164	600	625	500	525	....
Mean monthly discharge, 1914.	.....	.....	.....	.....	.....	.....	89	38	134	101	93	24	80
do 1915.	15	17	68	115	101	64	65	19	18	215	187	202	90
do 1916.	20	102	65	57	109	232	170	92	45	26	162	62	95
Minimum daily discharge......	5	8	8	41	63	46	39	13	4	10	14	11	....

Note—Stream occasionally freezes over at gauging station.

72c—BRANDT CREEK—at mouth. Records available : Oct. 19, 1912, to Sept. 11, 1914—station abandoned and new station above Young creek used.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge.....	610	140	190	280	245	237	174	48	174	408	408	246	....
Mean monthly discharge, 1912.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	113	38	....
do 1913.	16	25	26	85	124	115	51	10	34	47	105	55	58
do 1914.	81	37	80	109	97	65	18	6	.....	.....	.....	.....	....
Minimum daily discharge.....	10	9	12	16	30	26	7	5	6	8	14	18	....

72d—BRANDT CREEK—above confluence of Young creek. Records available · June 1, 1913, to Dec. 31, 1916.

	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge.....	23·0	17·0	100·0	50·0	42·0	76·0	54·0	5·5	250·0	220·0	160·0	320·0	....
Mean monthly discharge, 1913.	.....	.....	.....	.....	.....	40·9	25·5	2·6	3·9	19·3	7·1	3·0	....
do 1914.	.....	.....	.....	.....	24·0	12·0	9·1	0·6	33·0	.....	.....	.....	....
do 1915.	8·8	7·3	21·0	19·0	21·0	4·5	2·4	0·8	1·8	43·0	21·0	102·0	21·0
do 1916.	4·1	5·3	3·5	3·7	3·2	19·8	3·5	0·6	0·5	0·7	53·0	1·4	8·3
Minimum daily discharge......	1·7	1·3	0·8	2·0	0·8	1·2	0·6	0·3	0·3	0·1	1·2	0·2	....

Note—Jan. to April and Oct. to Dec., 1914. Gauge heights were not recorded frequently enough to [illegible] estimates of mean discharges to be made.

72e—HIXON CREEK—about one-half mile from the mouth. Records available : Nov., [illegible] to July, 1914, station discontinued.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge.....	750	185	185	650	675	525	344	142	167	661	702	200	....
Mean monthly discharge, 1912.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	149	69	....
do 1913.	67	53	67	105	246	273	178	90	60	104	166	85	124
do 1914.	173	64	114	202	199	155	.....	.....	.....	.....	.....	.....	....
Minimum daily discharge.	44	20	47	55	75	60	95	70	34	31	40	37	....

Note—Mean discharge for Sept., 1913, partly estimated ; gauge washed out.

72f—HIXON CREEK—about 1 mile above the confluence of Belknap creek. Records available : April to Sept., 1914; July to Dec., 1915; May to Dec. 1916.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge	7	71	54	46	76	80	54	26	16	80	71	54	......
Mean monthly discharge, 1914	......	......	......	......	......	28	23	7	......	......	......	......	......
do 1915	......	......	......	......	......	......	10	3	4	29	27	34	......
do 1916	3	19	20	28	31	43	26	17	8	6	34	10	20
Minimum daily discharge	2	2	4	10	10	10	4	3	2	2	5	3	......

Note—During April, May and Sept., 1914, insufficient gauge readings were taken to enable estimates of mean monthly discharge to be made.

72g—NORTON CREEK—at outlet of Norton lake. Records available : Oct., 1912, to Dec., 1916.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge	20·0	50·0	48·0	43·0	46·0	22·0	18·0	12·0	36·0	85·0	69·0	32·0	......
Mean monthly discharge, 1912	......	......	......	......	......	......	......	......	......	......	15·5	5·6	......
do 1913	2·5	3·9	2·9	6·4	19·0	8·7	3·8	0·9	7·0	9·5	23·8	10·0	8·2
do 1914	......	4·3	13·2	15·5	61·6	3·7	1·1	0·3	8·2	15·1	19·4	4·0	13·3
do 1915	9·0	9·0	15·0	16·0	5·0	2·0	0·8	0·2	0·5	17·1	10·9	13·2	8·2
do 1916	3·5	13·0	10·4	14·0	22·0	13·0	10·0	4·8	2·4	1·2	5·6	0·6	8·4
Minimum daily discharge	1·6	1·2	2·7	2·7	1·0	1·0	0·4	0·1	0·1	0·1	0·7	0·1	......

72h—YOUNG CREEK—at mouth. Records available : Oct., 1912, to Dec., 1915.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Maximum daily discharge	44	53	110	190	63	92	55	14	110	170	130	130	......
Mean monthly discharge, 1914	......	......	......	......	31	18	10	4	27	36	57	8	24
do 1915	13	26	35	52	24	10	7	5	4	37	25	41	23
do 1916	10	23	32	36	27	52	19	8	4	5	31	10	22
Minimum daily discharge	2·4	4·2	13	17	13	5	3·5	2·4	0·8	0·4	2	6·6	......

Note—Owing to infrequency of gauge readings, means for certain months are omitted.

73—MOYIE RIVER—at international boundary Drainage area, 590 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge, near Kingsgate ; 25 yards north of international boundary.

Records available—July, 1914, to Dec., 1915, March to Dec., 1916.

Gauge—Vertical staff attached to the abutment of highway bridge ; read daily.

Channel—Is straight for 200 feet above and below section ; flow is swift, over gravel and small boulders. Width of stream at measuring section, 44 to 97 feet.

Discharge measurements—Are reliable and well define the rating curve.†

Winter flow—The river, as a rule, does not freeze over, but ice conditions obtain from November to March.

Accuracy—Results are considered to be within 15 per cent ; 1916, up to 4,500 sec.-ft. A, above 4,500 sec.-ft. B.

General—The Moyie river is an international stream. There are lumbering and mining interests on the watershed.

* Above gauging station, including a small area in the United States.

† Some discharge measurements have been made at the bridge at Eastport, Idaho, which is about 100 yds. downstream from the Kingsgate bridge. As these measurements indicated that water is lost in the stream bed between the two bridges, the lower station was abandoned.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					Aug. 23	104	1·78	0·80	186 [1]
July 7	247	4·61	2·10	1,140	Nov. 24	89	2·42	0·89	215
Aug. 1	122	2·73	0·80	333	1916				
Oct. 8	80	2·66	0·75	213	Feb. 21	82	1·10	Ice	90 [3]
" 15	83	2·72	0·80	225	June 15	686	10·90	7·00	7,510
" 15	97	1·89	1·10	183 [1]	" 16	706	11·26	7·20	7,950
1915					" 16	706	11·01	7·20	7,780
Feb. 20	66	2·14	0·65	142	July 6	397	6·50	3·60	2,580
April 21	370	6·42	3·40	2,370	" 24	200	3·75	1·68	749
June 2	270	5·17	2·55	1,390	Aug. 13	118	2·45	0·90	288
July 23	133	2·77	1·20	370	" 14	86	3·33	0·89	285 [2]
" 23	136	2·31	1·45	314 [1]	Sept. 17	92	1·91	0·63	175 [4]
Aug. 24	80	2·24	0·78	179	Oct. 9	84	1·56	0·50	131 [4]

[1] At United States bridge. [2] Ice measurement. [3] Wading measurement at different sections. [4] Measurement from downstream side of bridge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1914					
July	....	....	....	....	....	July [1]	958	283	....	....	....
Aug.	....	....	....	....	....	Aug.	304	129	189	0·32	0·37
Sept.	....	....	....	....	....	Sept.	243	105	147	0·25	0·28
Oct.	....	....	....	....	....	Oct.	348	172	221	0·37	0·43
Nov.	....	....	....	....	....	Nov.	958	348	582	0·99	1·11
Dec.	....	....	....	....	....	Dec. [2]	451	348	....	....	....
1915						1916					
Jan. [3]	....	....	....	....	....	Jan.	....	....	....	....	....
Feb. [3]	....	....	....	....	....	Feb.	....	....	....	....	....
Mar.	510	129	262	0·44	0·51	Mar.	....	....	....	....	....
April	2,620	424	1,460	2·48	2·77	April	2,840	1,210	1,770	3·00	3·35
May	2,430	1,600	1,850	3·14	3·61	May	5,360	2,110	3,050	5·17	5·96
June	1,440	480	858	1·45	1·62	June	10,600	2,840	5,460	9·25	10·32
July	710	223	401	0·69	0·79	July	3,640	500	1,550	2·63	3·03
Aug.	348	142	214	0·36	0·41	Aug.	472	170	290	0·49	0·56
Sept.	187	117	147	0·25	0·28	Sept.	335	130	177	0·30	0·33
Oct.	223	156	181	0·31	0·36	Oct.	130	95	109	0·18	0·21
Nov.	283	187	229	0·39	0·43	Nov.	190	130	158	0·27	0·30
Dec.	304	180	219	0·37	0·43	Dec.	110	110	110	0·19	0·22
Period	2,620	117	582	0·99	11·21	Period	10,600	95	1,408	2·39	24·28

[1] For period July 7 to 31, max. on July 7, min. on July 31. [2] For period Dec. 1 to 9, after which gauge heights were affected by ice. [3] Affected by ice Jan. 1 to 7 and Jan. 26 to Feb. 16.

74—**MURTLE RIVER**—15 miles below lake

Drainage area, about 400 square miles

DESCRIPTION OF GAUGING STATION

Location—At the Clearwater Trail crossing, 15 miles below Murtle lake, and about 50 miles by pack trail from the Canadian Northern Ry. at Raft River P.O.

Records available—Gauge readings have been taken since September, 1914, w[illegible] will be available when the station is completely rated.

Drainage area—Only part of the watershed of the Murtle river has been surveyed, and there are not enough data available to make a close estimate.

Gauge—A Gurley automatic water gauge register was installed in November, 1915, but record was interrupted by accident and ice. Before November, 1915, a chain gauge was in use; read from one to four times a week

Channel—The bed of the stream is composed of rocks and gravel, and is smooth and even. The current is swift.

Discharge measurements—Rating curve is well defined at high stages.

Winter flow—Ice conditions obtain from Nov. to Mar. In Jan., 1917, ice was 2 ft. thick.

Accuracy—Results should be fairly reliable for the period during which gauge was recording. The inaccessibility of this station makes accurate records difficult to obtain.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					June 15	878	4·43	5·48	3,890
Sept. 1	....	....	1·1[1]	852	" 16	933	4·65	5·65	4,340
1915					" 17	996	4·82	5·90	4,810
Aug. 8	507	3·1	3·82[2]	1,610	" 18	1,030	5·10	6·13	5,350
Nov. 20	297	2·2	2·83	650	" 19	1,186	5·40	6·58	6,400
1916					Sept. 5	400	2·85	3·63	1,150
June 4	777	4·18	5·05	3,250	Nov. 14	348	1·62	Ice	565
" 9	807	4·12	5·10	3,320	1917				
" 14	823	4·24	5·28	3,500	Feb. 1	200	0·95	Ice	190

[1] Old gauge; 3·10 on automatic gauge. [2] Automatic gauge datum.

GAUGE HEIGHTS AND DISCHARGES

During 1914 and 1915, the gauge readings were not taken frequently enough to permit the making of satisfactory estimates of monthly mean discharges. The following is a record of the gauge heights actually recorded and corresponding revised estimated discharges.

Date	Gauge height	Discharge
	Feet	*Sec.-ft.*
1914		
Sept. 2	3·10	825
" 9	3·10	825
" 14	3·10	825
" 23	3·30	990
" 25	3·30	990
Oct. 1	3·70	1,380
" 10	3·50	1,175
" 16	3·40	1,080
" 23	3·45	1,130
" 29	3·40	1,080
Nov. 7	3·35	1,035
" 14	3·25	950
" 18	3·15	865
" 26	3·05	790
" 29	3·05	790
Dec. 4	3·05	790
" 5	3·05	790
" 11	3·15	865
" 12	3·15	865
" 19	Ice	....
" 28	Ice	....
1913		
Jan. 4	3·05	790
" 5	3·05	790
" 14	2·85	650
" 15	2·85	650
" 21	2·85	650
" 22	2·85	650
" 28	Ice	....
Feb. 5	Ice	....
" 6	Ice	....
" 13	Ice	....
" 14	Ice	....
" 21	Ice	....
" 22	Ice	....
" 28	2·75	....

Date	Gauge height	Discharge
	Feet	*Sec.-ft.*
1915		
Mar. 1	2·70	555
" 7	2·50	450
" 8	2·50	450
" 15	2·60	500
" 16	2·50	450
" 21	2·50	450
" 28	2·50	450
" 29	2·50	450
Apr. 4	2·80	615
" 16	3·40	1,080
" 17	3·50	1,175
" 18	3·60	1,275
" 19	3·65	1,330
" 20	3·70	1,380
" 21	3·75	1,435
" 22	3·80	1,490
" 23	3·80	1,490
" 24	3·85	1,550
" 30	4·35	2,085
May 1	4·25	1,950
" 9	5·15	3,355
" 14	5·55	4,095
" 15	5·55	4,095
" 16	5·55	4,095
" 17	5·50	4,000
" 18	5·40	3,815
" 27	5·75	4,480
" 28	5·80	4,580
" 31	5·55	4,095
June 1	5·55	4,095
" 3	5·40	3,815
" 4	5·35	3,725
" 12	4·85	2,850
" 13	4·95	3,015
" 15	4·80	2,765
" 16	4·85	2,850
" 18	4·70	2,605
" 19	4·75	2,685

Date	Gauge height	Discharge
	Feet	*Sec.-ft.*
1915		
June 21	4·60	2,450
" 22	4·65	2,530
" 26	5·80	4,580
" 27	5·75	4,480
" 30	4·55	2,375
July 1	4·45	2,230
" 4	4·35	2,085
" 5	4·30	2,015
" 12	4·45	2,230
" 13	4·45	2,230
" 18	5·05	3,190
" 19	5·00	3,100
" 23	4·35	2,085
" 24	4·30	2,015
" 26	4·25	1,950
" 27	4·25	1,950
" 28	4·25	1,950
" 29	4·20	1,880
Aug. 2	4·00	1,725
" 3	4·00	1,725
" 5	3·85	1,550
" 6	3·85	1,550
" 7	3·80	1,490
" 8	3·80	1,490
" 9	3·75	1,435
" 12	3·55	1,225
" 13	3·65	1,330
" 16	3·50	1,175
" 17	3·55	1,225
" 20	3·42	1,100
" 21	3·45	1,130
" 23	3·37	1,055
" 24	3·40	1,080
" 27	3·30	990
" 28	3·32	1,010
" 30	3·30	990
" 31	3·28	975

Date	Gauge height	Discharge
	Feet	*Sec.-ft.*
1915		
Sept. 2	3·25	950
" 3	3·22	920
" 6	3·17	885
" 7	3·15	865
" 9	3·05	790
" 10	3·05	790
" 14	3·00	750
" 15	3·00	750
" 17	2·98	740
" 18	2·95	715
" 21	2·90	680
" 22	2·90	680
" 24	2·85	650
" 25	2·85	650
" 29	2·80	615
" 30	2·80	615
Oct. 1	2·85	650
" 2	2·85	650
" 7	2·75	585
" 8	2·75	585
" 10	2·72	565
" 11	2·70	555
" 18	2·80	615
" 19	2·85	650
" 22	2·95	715
" 23	2·95	715
" 27	3·15	865
" 28	3·15	865
Nov. 2	3·10	825
" 3	3·05	790
" 7	3·05	790
" 8	3·05	790
" 9	3·00	750
" 11	2·95	715
" 13	2·90	680
" 19	2·84	640
" 20	2·83	635

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1916				
June	7,000	2,600	4,746	11·87	13·25
July	5,680	3,100	4,046	10·12	11·66
Aug.	2,930	1,350	2,016	5·04	5·81
Sept.[1]	....	....	....	....	....

[1] Mean monthly discharge Sept. 1 to 9, 1,315 sec.-ft.

75—NAHATLATCH RIVER—7 miles from mouth

Drainage area, about 400 square miles.

DESCRIPTION OF GAUGING STATION

Location—Seven miles from mouth, below Douglas and Log creeks. Sec. 7, tp. 12, rge. 26, W. 6th mer.

Records available—Weekly records, Mar., 1912, to Apr., 1916 ; daily records May to Dec., 1916.

Drainage area—The watershed is not well defined on existing maps, which, for this region, differ considerably. The estimate may be somewhat low.

Gauge—Standard vertical staff gauge, read weekly ; also, since April 27, 1916, auxiliary gauge, read daily, the readings being transferred to main gauge.

Channel—At section, is straight, with an average depth at low water of 8 feet. Velocity low. Bed of river rocky and permanent.

Discharge measurements—Are made from cable car.

Winter flow—Open conditions generally prevail throughout the winter, though partial ice conditions sometimes obtain, as in Jan. and Feb., 1916.

Accuracy—The discharge estimates given below for days on which the gauge was read are revised figures. For 1916, the results are considered quite reliable.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912					1915				
July 23	....	....	3·75	1,920	Feb. 15	262	1·10	3·40	290
Nov. 28	....	....	2·20	891	1916				
1913					April 19	414	3·60	3·10	1,490
June 26	747	6·47	6·4	4,640	June 26	830	9·80	8·50	8,100
July 4	627	5·09	4·95	3,196	Nov. 4	272	2·00	1·33	550
Sept. 21	431	2·96	2·65	1,273	1917				
					Jan. 11	220	1·36	0·41	299

GAUGE HEIGHTS AND DISCHARGES

Owing to the infrequency of gauge readings up to 1915 it was not deemed advisable to interpolate discharges and give monthly summaries. The following is a record of the gauge heights and corresponding estimated discharges that are available.

1912			1913			1914			1915		
Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
....	....	....	Jan. 4	1·00	480	Jan. 4	2·60	1,140	Jan. 2	1·30	570
....	....	....	" 12	0·85	420	" 11	2·32	980	" 10	1·10	510
....	....	....	" 19	0·80	410	" 18	1·70	700	" 17	0·90	440
Feb. 27	0·95	460	" 26	0·85	420	" 25	1·60	660	" 23	0·70	380
Mar. 4	0·75	400	Feb. 2	0·65	360	Feb. 1	1·40	600	" 30	0·65	360
" 11	0·65	360	" 9	0·50	320	" 8	1·10	510	Feb. 7	0·70	380
" 18	0·65	260	" 16	1·10	510	" 15	0·90	440	" 15	0·75	390
" 25	0·50	320	" 23	0·75	390	" 22	0·80	410	" 21	0·70	380
April 1	1·45	610	Mar. 2	0·55	330	Mar. 1	1·20	540	" 28	0·80	410
" 8	1·70	700	" 9	0·70	380	" 8	1·10	510	Mar. 7	0·95	460
" 14	2·00	820	" 16	0·75	390	" 15	1·95	800	" 14	1·05	490
" 21	2·40	1,020	" 23	0·70	380	" 22	2·95	1,360	" 21	1·45	610
" 28	2·35	1,000	" 29	0·65	360	" 29	2·25	950	" 28	2·55	1,100
May 5	3·30	1,620	April 6	0·70	380	April 5	2·60	1,140	April 4	6·15	4,400
" 12	5·70	3,900	" 13	1·90	780	" 12	4·30	2,450	" 11	3·75	1,980
" 19	5·50	3,650	" 20	3·35	1,660	" 19	4·10	2,250	17	5·50	3,650
" 26	5·70	3,900	" 26	2·80	1,260	" 26	3·35	1,660	" 24	4·50	2,650
June 2	4·10	2,250	May 4	1·90	780	May 3	6·30	4,600	May 2	3·50	1,780
" 9	6·40	4,750	" 12	5·10	3,200	" 10	5·50	3,650	" 9	7·20	5,850
" 16	4·50	2,650	" 18	4·00	2,200	" 17	6·00	4,250	" 16	4·25	2,400
" 23	6·25	4,550	" 25	6·70	5,150	" 22	7·50	6,300	" 23	4·80	2,900
" 30	4·40	2,550	June 1	8·00	7,100	" 24	8·20	7,500	" 30	4·45	2,600
July 7	3·80	2,020	" 8	7·75	6,700	" 30	4·70	2,800	June 6	6·50	4,850
" 14	4·55	2,670	" 15	6·30	4,600	June 6	5·20	3,350	" 13	5·00	3,100
" 18	4·55	2,670	" 22	5·90	4,100	" 13	6·80	5,300	" 20	4·20	2,350
" 21	4·35	2,500	" 26	6·20	4,500	" 20	7·00	5,550	" 27	3·95	2,150
" 23	3·75	1,980	" 29	6·80	5,300	" 27	6·40	4,750	July 4	5·80	4,000
" 28	3·20	1,540	July 4	5·00	3,100	July 4	8·20	7,500	" 11	3·70	1,940

GAUGE HEIGHT AND DISCHARGES—*Continued*

1912			1913			1914			1915		
Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Aug. 4	3·55	1,820	July 6	5·40	3,550	July 11	7·00	5,550	July 18	3·30	1,620
" 7	3·45	1,740	" 13	4·85	2,950	" 9	6·10	4,350	" 25	4·00	2,200
" 11	4·35	2,500	" 20	6·30	4,600	" 26	4·30	2,450	Aug. 1	4·20	2,350
" 18	3·65	1,900	" 29	5·25	3,400	Aug. 2	3·95	2,150	" 8	3·20	1,540
" 25	3·75	1,980	Aug. 2	4·80	2,900	" 9	3·20	1,540	" 15	3·35	1,660
Sept. 1	2·20	920	" 10	3·90	2,100	" 16	3·80	2,020	" 22	3·90	2,100
" 8	2·30	970	" 17	3·15	1,500	" 23	3·20	1,540	" 29	3·05	1,430
" 15	2·55	1,100	" 24	3·85	2,060	" 30	3·00	1,400	Sept. 5	2·75	1,230
" 22	2·10	870	" 31	3·35	1,660	Sept. 6	2·10	870	" 12	1·50	630
" 29	1·60	660	Sept. 7	4·70	2,800	" 13	1·80	740	" 19	1·60	660
Oct. 6	2·00	820	" 15	3·50	1,780	" 20	3·20	1,540	" 26	1·50	630
" 13	1·40	600	" 21	2·65	1,170	" 27	3·00	1,400	Oct. 3	1·95	800
" 20	2·10	870	" 27	2·20	920	Oct. 4	2·45	1,050	" 10	0·90	440
" 27	1·80	740	Oct. 4	1·90	780	" 11	2·20	920	" 17	1·00	480
Nov. 3	1·[illegible]0	600	" 12	4·75	2,850	" 18	6·40	4,750	" 24	3·45	1,740
" 10	[illegible]40	600	" 19	2·75	1,230	" 25	3·20	1,540	" 31	4·00	2,200
" 17	[illegible]·20	920	" 25	2·85	1,300	Nov. 1	6·00	4,250	Nov. 7	3·35	1,660
" 24	2·80	1,260	Nov. 2	1·80	74[illegible]	" 8	3·90	2,100	" 14	1·55	640
" 28	2·20	920	" 9	2·25	950	" 15	3·00	1,400	" 21	1·70	700
Dec. 1	1·90	780	" 16	2·60	1,140	" 22	2·60	1,140	" 28	1·40	600
" 7	1·50	630	" 23	1·90	780	" 28	3·80	2,020	Dec. 5	1·50	630
" 15	1·30	570	" 30	2·20	920	Dec. 6	2·40	1,020	" 12	1·30	570
" 22	1·15	520	Dec. 7	1·70	704	" 13	1·60	660	" 19	1·00	480
" 29	1·25	550	" 14	1·40	600	" 20	1·60	660	" 26	1·05	490
			" 21	1·30	570	" 26	1·50	630			
			" 28	1·20	540						
1916											
Jan. 2	0·8	410	Feb. 6	Ice	....	Mar. 4	2·6	1,140	April 2	2·5	1,[illegible]
" 9	0·8	410	" 13	Ice	....	" 12	5·4	3,550	" 9	3·3	1,6[illegible]
" 16	Ice	....	" 19	3·3	1,620	" 19	2·7	1,200	" 16	3·4	1,700
" 22	Ice	....	" 26	2·2	920	" 26	2·5	1,080	" 19	3·1	1,470
									" 23	2·6	1,140

Note.—From April 27, daily readings were taken and interpolations were made to estimate the mean flow for April.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1916					
April...	......	......	......	......	......	April...	2,350	1,080	1,550	3·87	4·32
May...	......	......	......	......	......	May...	5,300	1,860	3,330	8·32	9·59
June...	......	......	......	......	......	June..	11,700	3,650	6,240	15·60	17·40
July...	......	......	......	......	......	July...	6,150	2,900	4,550	11·37	13·20
Aug....	......	......	......	......	......	Aug....	3,750	1,620	2,800	7·00	8·07
Sept....	......	......	......	......	......	Sept....	2,200	700	1,170	2·92	3·26
Oct....	......	......	......	......	......	Oct....	700	410	540	1·35	1·55
Nov....	......	......	......	......	......	Nov....	570	380	450	1·12	1·25
Dec....	......	......	......	......	......	Dec....	440	270	340	0·85	0·98
Period..	......	......	......	......	......	Period..	11,700	270	2,330	5·82	59·62

76—NAHATLATCH RIVER—below lakes

Drainage area, 300 square miles

DESCRIPTION OF GAUGING STATION

Location—200 yards below lowest lake; in sec. 14, tp. 12, rge. 27, W. 6th mer.

Records available—Feb. 26, 1912, to Dec. 31, 1916.

Drainage area—The watershed is not well defined on existing maps, which differ considerably. The actual drainage area may be more than 300 sq. miles.

Gauge—Standard chain gauge, replaced on April 18, 1916, by vertical staff in two sections; read weekly.

Channel—Is straight at measuring section; bed, rock and boulders. Velocities are fairly high.

Discharge measurements—Are made from cable car and rating curve is well defined.

Winter flow—Open conditions prevail throughout the winter.

Accuracy—Since the installation of the vertical staff gauge results should be quite reliable. The accuracy of the earlier records is somewhat impaired by the stretching of the chain gauge. The weekly readings do not enable satisfactory monthly summaries to be prepared.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912					1914				
Feb. 25	256	1·6	3·45	417	May 20	793	4·35	8·55	3,452
July 18	530	3·6	6·58	1,930	" 30	627	3·60	6·70	2,235
Nov. 28	381	2·1	4·75	817	1916				
1913					April 18	431	2·93	5·50	1,265
June 26	764	5·0	8·1	3,650	June 27	1,050	6·59	10·60	6,920
Sept. 21	437	2·37	5·1	1,030	Nov. 4	300	1·50	3·75	449
					1917				
					Jan. 10	238	·97	3·00	230

GAUGE HEIGHTS AND DISCHARGES

Owing to the infrequency of gauge readings it was not deemed advisable to prepare monthly summaries by interpolating discharges. The following is a record of the gauge heights actually recorded and corresponding discharges.

1912			1913			1914			1915		
Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge
	Feet	Sec.-ft.		Feet	Sec.-ft.		Feet	Sec.-ft.		Feet	Sec.-ft.
....	....	....	Jan. 4	3·45	412	Jan. 4	4·76	940	Jan. 2	3·70	420
....	....	....	" 12	3·55	377	" 11	4·86	990	" 10	3·60	380
....	....	....	" 19	3·35	377	" 18	4·26	714	" 17	3·50	350
Feb. 26	3·45	415	" 26	3·55	447	" 25	3·86	556	" 23	3·30	290
Mar. 4	3·25	380	Feb. 2	3·35	377	Feb. 1	3·84	549	" 30	3·30	290
" 11	3·20	375	" 9	3·25	345	" 8	3·74	514	Feb. 7	3·20	270
" 18	3·20	375	" 16	3·80	535	" 15	3·54	444	" 15	3·30	290
" 25	3·10	365	" 23	3·50	430	" 22	3·14	400	" 21	3·30	290
April 1	3·95	520	Mar. 2	3·30	360	Mar. 1	3·67	489	" 28	3·30	290
" 8	4·10	560	" 9	3·35	377	" 8	3·52	437	Mar. 7	3·40	320
" 14	4·40	660	" 16	3·40	395	" 15	4·42	784	" 14	3·60	380
" 21	4·80	830	" 23	3·30	360	" 22	5·27	1,208	" 21	4·60	780
" 28	4·70	785	" 29	3·30	360	" 30	4·57	851	" 28	5·00	1,000
May 5	5·60	1,270	April 6	3·30	360	April 5	4·79	955	April 4	8·30	3,700
" 12	7·80	2,815	" 13	4·30	730	" 12	6·59	2,131	" 11	5·90	1,530
" 19	7·40	2,415	" 20	5·70	1,465	" 19	6·19	1,797	" 17	7·50	2,900
" 26	7·80	2,815	" 27	5·10	1,115	" 26	5·59	1,394	" 24	6·60	2,050
June 2	6·40	1,800	May 4	4·30	730	May 3	8·46	4,066	May 3	5·70	1,400
" 9	8·70	3,490	" 11	7·25	2,760	" 10	7·41	2,920	" 9	8·70	4,200
" 16	6·95	2,295	" 18	5·95	1,627	" 17	8·56	4,176	" 16	6·40	1,900
" 23	6·60	1.940	" 25	8·35	3,945	" 21	8·50	4,110	" 23	7·00	2,400
" 30	5·70	1,330	June 1	9·40	5,120	" 24	9·90	5,760	" 30	6·70	2,100
July 7	6·30	1,730	" 8	9·30	5,000	" 29	6·80	2,320	June 6	8·40	3,800
" 14	7·20	2,370	" 15	8·15	3,725	" 30	6·70	2,230	" 13	7·00	2,400
" 18	6·70	2,010	" 22	7·90	3,450	June 6	7·30	2,810	" 20	6·50	1,950
" 21	6·70	2,010	" 26	8·30	3,890	" 13	8·50	4,110	" 27	6·20	1,750
" 23	6·60	1,940	" 29	8·60	4,220	" 20	8·20	3,780	July 4	8·00	3,400
" 28	5·75	1,360	July 6	7·75	3,285	" 27	8·40	4,000	" 11	5·80	1,460
Aug. 4	6·15	1,625	" 13	7·20	2,710	July 4	10·00	5,900	" 18	5·60	1,330
" 7	5·95	1,490	" 20	8·60	4,220	" 11	8·90	[illegible],550	" 25	6·30	1,800
" 11	6·90	2,155	" 27	7·60	3,120	" 19	8·30	3,890	Aug. 1	6·50	1,950
" 18	6·00	1,525	Aug. 2	7·10	2,610	" 26	6·50	2,050	" 8	5·60	1,330
" 25	6·40	1,800	" 10	6·30	1,880	Aug. 2	6·00	1,660	" 15	6·80	2,200
Sept. 1	4·70	785	" 17	5·40	1,280	" 9	5·50	1,340	" 22	6·30	1,800
" 8	4·80	830	" 24	6·30	1,880	" 16	6·10	1,730	" 29	5·50	1,260
" 15	5·25	1,060	Sept. 7	7·10	2,610	" 23	5·60	1,400	Sept. 5	5·20	1,100
" 22	4·50	700	" 14	5·90	1,595	" 30	5·50	1,340	" 12	4·10	570
" 29	4·10	560	" 21	5·10	1,115	Sept. 6	4·50	820	" 19	4·10	570
Oct. 6	4·55	720	" 27	4·60	865	" 13	4·20	690	" 26	3·90	490
" 13	3·90	510	Oct. [illegible]	4·35	752	" 20	6·00	1,660	Oct. 3	4·40	700
" 20	4·65	760	" 12	7·00	2,510	" 27	5·60	1,400	" 10	3·40	320
" 27	4·30	625	" 19	5·10	1,115	Oct. 4	4·95	1,035	" 17	3·40	320
Nov. 3	3·90	510	" 25	5·20	1,170	" 11	4·60	865	" 24	5·80	1,460
" 10	4·00	535	Nov. 2	4·50	710	" 18	8·50	4,110	" 31	6·20	1,750
" 17	4·70	785	" 9	4·30	730	" 25	5·50	1,340	Nov. 7	4·60	780
" 24	5·15	1,010	" 11	5·00	1,160	Nov. 1	8·15	3,725	" 14	2·90	200
" 28	4·75	805	" 23	4·30	730	" 8	6·10	1,730	" 21	3·40	320
Dec. 1	4·45	680	" 30	4·80	960	" 15	5·30	1,225	" 28	3·30	290
" 7	4·10	560	Dec. 7	4·20	690	" 22	5·00	1,160	Dec. 5	3·60	380
" 15	3·55	430	" 14	4·00	610	" 28	6·00	1,660	" 12	3·50	350
" 22	3·70	460	" 21	3·90	570	Dec. 6	4·90	1,010	" 19	3·40	320
" 29	4·00	[illegible]	" 28	3·80	535	" 13	4·10	650	" 26	3·50	350
						" 20	4·10	650			
						" 26	3·90	570			

GAUGE HEIGHTS AND DISCHARGES—*Continued*

1916

Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge	Date	Gauge height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Jan. 2	3·30	290	Apr. 2	4·90	940	July 2	9·20	4,850	Oct. 8	3·50	350
" 9	3·30	290	" 9	5·60	1,330	" 9	9·40	5,150	" 15	3·75	435
" 16	3·20	270	" 16	5·70	1,400	16	8·50	3,950	" 22	3·60	380
" 22	3·10	130	18	·50	1,260	" 23	8·40	3,800	Nov. 4	3·75	435
" 30	3·20	270	" 23	4·90	940	" 30	7·30	2,700	" 12	3·50	350
Feb. 6	3·00	220	" 29	6·50	1,950	Aug. 6	7·45	2,850	" 18	3·20	270
" 13	3·10	250	May 7	8·15	3,550	" 13	7·40	2,800	" 25	3·20	270
" 19	5·70	1,400	" 14	5·85	1,500	" 20	5·70	1,400	Dec 2	3·25	280
" 13	4·30	650	" 21	7·50	2,900	" 27	6·70	2,100	" 9	3·15	260
Mar. 4	4·60	780	" 28	8·35	3,750	Sept. 3	6·00	1,600	" 16	3·00	220
" 12	7·60	3,000	June 4	9·35	5,080	" 10	5·05	1,020	" 23	2·95	210
" 19	5·10	1,050	" 11	7·95	3,350	" 17	4·55	760	" 31	2·80	180
" 26	5·00	1,000	" 18	12·50	10,400	" 24	4·80	800			
			" 25	10·40	6,650	" 30	4·20	610			
			" 27	10·60	6,950						

77—NANAIMO RIVER—6 miles from mouth

Drainage area, 250 square miles

DESCRIPTION OF GAUGING STATION

Location—6 miles from mouth ; 800 feet upstream from Canadian Collieries Ry. bridge ; 8 miles from Ladysmith.

Records available—Feb. 11, 1913, to Dec. 31, 1916.

Co-operation—Provincial Water Rights Branch established station in 1913.

Gauge—12-foot wooden staff nailed to tree, left bank, 25 feet upstream from section ; read daily.

Channel—Straight for 200 feet on each side of section ; even, gravel bed, good control 400 feet downstream.

Discharge measurements—Well define rating curve except at highest stages.

Winter flow—Open all winter.

Accuracy—B up to discharge of 3,000 sec.-ft. ; C above discharge of 3,000 sec.-ft. Monthly summary given below for 1913 embodies revisions based on later measurements. See Note page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					Aug. 10	139	0·67	0·80	93
Dec. 20	372	2·88	2·75	1,070	1915				
1913					Mar. 25	467	3·40	3·27	1,620
Feb 11	266	1·88	2·04	498	Sept. 1	78	0·46	0·40	35·6
Sept. 27	157	0·98	1·17	154	Dec. 11	556	4·64	4·01	2,580
Dec. 8	436	4·00	3·35	1,736	1916				
" 15	583	4·88	4·25	2,852	Mar. 29	472	3·88	3·45	1,830
1914					Nov. 3	586	5·96	4·44	3,490
July 8	240	1·32	1·60	317					

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	1,500	635	912	3·65	4·20
April	2,755	770	1,496	5·98	6·67
May	2,370	790	1,444	5·78	6·66
June	1,745	750	1,009	4·04	4·50
July	1,050	265	622	2·49	2·87
Aug.	260	106	173	0·69	0·79
Sept.	1,825	95	549	2·20	2·45
Oct.	5,525	335	937	3·75	4·33
Nov.	11,420	390	3,373	13·49	15·07
Dec.	3,670	650	1,657	6·63	7·63
Period	11,420	95	1,217	4·87	55·17

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	25,300	770	3,840	15·36	17·71
Feb.	4,980	570	1,240	4·96	5·16
Mar.	8,320	980	2,520	10·08	11·62
April	6,510	980	2,430	9·72	10·84
May	1,650	690	1,070	4·28	4·93
June	840	500	650	2·60	2·90
July	485	130	265	1·06	1·22
Aug.	[illegible]	70	95	0·38	0·44
Sept.	1,220	68	335	1·34	1·50
Oct.	11,600	360	3,290	13·16	15·16
Nov.	10,650	850	4,390	17·56	19·60
Dec.	3,140	330	740	2·96	3·41
Year	[illegible]5,300	68	1,739	6·96	94·49

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1915				
Jan.	4,750	420	1,410	5·64	6·50
Feb.	2,390	810	1,420	5·68	5·90
Mar.	6,070	750	1,740	6·96	8·02
April	9,660	460	1,795	7·18	8·01
May	840	395	573	2·29	2·64
June	485	140	269	1·08	1·21
July	140	81	108	0·43	0·49
Aug.	80	57	66	0·26	0·30
Sept.	65	55	59	0·24	0·27
Oct.	9,330	60	1,700	6·80	7·83
Nov.	5,430	530	1,680	6·72	7·50
Dec.	8,510	985	3,070	12·28	14·16
Year	9,660	55	1,157	4·63	62·83

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1916				
Jan.	1,250	297	602	2·41	2·78
Feb.	13,100	425	2,570	10·28	11·09
Mar.	7,400	1,010	3,050	12·20	14·07
April	3,050	1,180	1,900	7·60	8·48
May	3,340	1,010	1,940	7·76	8·95
June	2,990	1,060	1,520	6·08	6·78
July	1,240	475	790	3·16	3·64
Aug.	450	136	250	1·00	1·15
Sept.	130	62	86	0·34	0·38
Oct.	2,300	47	153	0·61	0·70
Nov.	3,910	267	1,080	4·32	4·82
Dec.	2,160	352	730	2·92	3·37
Year	13,100	47	1,220	4·88	66·21

78—NECHAKO RIVER—near Vanderhoof

Drainage area, about 9,500 square miles

DESCRIPTION OF GAUGING STATION

Location—At ferry crossing, about half-mile from Vanderhoof.

Records available—July 21 to Nov. 8, 1915.

Gauge—Chain gauge on right bank of river, about 25 yards above ferry landing ; read daily.

Channel—Permanent channel of even cross-section ; straight for 1,000 feet above and below section.

Discharge measurements—Are made from a canoe anchored to a tag-line, 50 feet above the ferry.

Winter flow—The river is usually frozen from early in November until April ; frazil and anchor ice affect the flow in early winter.

Accuracy—The section is good. and the meterings are well distributed. Results should be within 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915				
July 22	4,050	3·30	5·70	13,400
Aug. 25	2,730	2·77	2·60	7,580
Sept. 22	2,070	2·63	1·00	5,580
Oct. 20	1,600	2·43	−0·1	3,890

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1916 [1]				
Jan. 12	....	....	−0·70	2,905 [2]
Mar. 18	....	....	0·20	2,130 [2]
April 26	....	....	0·02	4,710
May 10	....	....	3·80	11,050
Aug. 10	....	....	4·50	12,870
" 20	....	....	3·50	10,640

[1] From "Miscellaneous Meter Measurements," *Water Resources Paper No. 21*, p. 356. [2] Ice.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Aug.	......	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1915				
Aug.	11,570	7,050	9,110	0·96	1·11
Sept.	7,050	4,780	5,830	0·61	0·68
Oct.	4,780	3,740	4,120	0·43	0·50

79—NECHAKO RIVER—near Fort Fraser

Drainage area, about 6,150 square miles

DESCRIPTION OF GAUGING STATION

Location—At the Grand Trunk Pacific Ry. bridge, about half-mile west of Fort Fraser townsite.

Records available—June 16 to Dec. 10, 1915.

Gauge—Vertical staff nailed to a timber pile on the left bank of river, about 75 feet above the railway bridge; read daily in the open season, and semi-weekly in the frozen season.

Channel—Straight above and below section; divided into sections by the bridge piers. There is a possibility of shift in the section due to current action around the piers of the bridge.

Discharge measurements—Are made from the bridge.

Winter flow—The river is usually frozen from mid-November until middle of April. During early winter, the flow is affected by anchor and frazil ice.

Accuracy—The station is newly established, but the conditions for meterings are good. The results should be within 15 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					1916[1]				
June 17	6,210	2·37	8·64	14,730	April 27	....	....	2·30	4,630
July 18	5,480	2·18	7·10	11,920	May 11	....	....	6·30	8,610
Aug. 26	3,950	1·67	4·20	6,610	Aug. 11	....	....	6·55	10,500
Sept. 23	3,180	1·40	2·68	4,440	" 21	....	....	5·50	9,150

[1] From "Miscellaneous Meter Measurements," *Water Resources Paper, No. 21*, p. 356.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
							1915.				
July....	....	....	....	....	....	July...	13,100	10,620	11,700	1·90	2·19
Aug.....	....	....	....	....	....	Aug....	10,450	6,300	8,120	1·32	1·52
Sept.....	....	....	....	....	....	Sept....	6,150	3,940	5,040	0·82	0·92
Oct.....	....	....	....	....	....	Oct....	3,880	3,000	3,330	0·54	0·62
Nov.....	....	....	....	....	....	Nov....	3,810	3,110	3,300	0·54	0·60
Dec.....	....	....	....	....	....	Dec.[1]..	....	....	....	....	....
Period...	....	....	....	....	....	Period..	13,100	3,000	6,298	1·02	5·85

[1] Ice conditions obtained after Dec. 11.

80—NICOLA RIVER—at mouth

Drainage area, 2,650 square miles

DESCRIPTION OF GAUGING STATION

Location—200 yards from mouth, on upstream side of highway bridge; in sec. 12, tp. 17, rge. 25, W. 6th mer.

Records available—Aug. 1 to Nov. 30, 1911; April 5 to Dec. 21, 1912; May 9 to Dec. 11, 1913; April 1 to Sept. 30, 1914; April 1 to Nov. 15, 1915; April 1 to Dec. 31, 1916.

Gauge—Inclined staff gauge; read three times a week.

Channel—Is straight at measuring section; velocity high; bed of stream, rocks and gravel; one channel at all stages. During high water on the Thompson river the control is affected at the measuring section, but not at the gauge.

Discharge measurements—Are made from bridge at all stages. None was made in 1915.

Winter flow—Ice conditions usually exist during January, February and March.

Accuracy—C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1913				
Aug. 8	244	3·3	2·65	816	May 9	490	5·44	5·40	2,586
Sept. 15	151	2·5	1·78	386	June 7	778	5·34	6·65	4,159
Oct. 24	116	1·5	1·30	176	Aug. 12	194	2·11	2·50	410
1912					1914				
Mar. 29	127	1·9	2·00	242	May 23	801	8·06	7·60	6,456
May 3	348	4·6	4·40	1,600	July 31	197	2·40	2·42	468
" 27	658	6·1	6·60	3,990	1916				
July 3	399	3·2	4·20	1,298	July 11	642	4·70	5·95	3,085
" 20	260	2·6	3·10	667	Sept. 2	192	1·65	2·50	318
Aug. 10	167	1·9	2·25	321	Nov. 14	139	1·17	1·58	163

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1911						**1912**					
April....	....	....	....	....	....	April[2]..	1,000	430	673	0·25	0·24
May....	....	....	....	....	....	May...	4,630	1,200	3,319	1·25	1·44
June....	....	....	....	....	....	June...	3,230	1,060	2,326	0·88	0 98
July....	....	....	....	....	....	July...	1,360	390	799	0·30	0·35
Aug.....	815	346	545	0·20	0·23	Aug....	660	300	391	0·15	0·17
Sept.....	422	220	335	0·13	0·14	Sept....	....	....	....	....	....
Oct.....	290	175	200	0·08	0·09	Oct....	360	195	244	0 09	0·10
Nov.[1]...	400	155	227	0·09	0·09	Nov....	430	215	306	0·11	0·12
Dec.....	....	....	....	....	....	Dec.[3].	330	155	226	0 09	0 07
1913						**1914**					
April....	....	....	....	....	....	April...	3,570	575	2,333	0·88	1·0
May[4]...	5,375	2,380	3,484	1·31	0·97	May...	7,740	3,570	5,664	2·14	2·4
June....	5,375	2,576	3,619	1·36	1·52	June...	5,345	2,270	3,385	1·28	1 4
July....	2,423	730	1,302	0·49	0·57	July...	2,270	430	1,216	0·46	0·5
Aug.....	700	180	402	0·15	0·17	Aug....	335	115	205	0·08	0·09
Sept.....	1,965	180	603	0·23	0·25	Sept....	240	100	162	0·06	0·07
Oct.....	725	180	444	0·17	0·19	Oct.[6].	240	210	....	....	....
Nov.....	544	356	439	0·17	0·18	Nov.[6]..	1,220	830	....	....	....
Dec.[5]....	337	145	220	0 08	0·03	Dec....	....	....	....	....	....
1915						**1916**					
April....	3,300	1,400	1,980	0·75	0·84	April...	3,060	1,000	1,650	0·62	0·69
May....	3,010	1,600	2,200	0·83	0·96	May...	6,690	3,200	4,800	1·81	2·09
June....	2,010	1,060	1,506	0·57	0·64	June...	8,060	4,570	5,680	2·14	2·39
July....	1,160	660	841	0·32	0·37	July...	4,740	1,270	2,500	0 94	1·08
Aug.....	720	215	374	0·14	0·16	Aug....	1,200	400	700	0·26	0·30
Sept.....	230	195	213	0·08	0·09	Sept....	380	240	280	0·11	0·12
Oct.[6]....	....	....	....	....	....	Oct....	335	170	250	0·09	0·10
Nov.[6].	....	....	....	....	....	Nov...	200	150	170	0·06	0·07
Dec.....	....	....	....	....	....	Dec....	140	110	125	0·05	0·06
Period...	3,300	195	1,185	0·45	3·06	Period.	8,060	110	1,673	0·63	6·90

[1] Partial ice conditions, mean discharge possibly high. [2] For period Apr. 5 to 30. [3] Dec. 1 to 21. [4] May 9 to 31. [5] Dec. 1 to 11. [6] Gauge readings not numerous enough to permit estimate of mean discharge.

81—NICOLA RIVER—at Merritt

Drainage area, 1,500 square miles

DESCRIPTION OF GAUGING STATION

Location—At Merritt, on upstream side of highway bridge immediately below mouth of Coldwater river.

Records available—June 16, 1911, to Dec. 31, 1914 ; April 1 to Sept. 30, 1915. Station discontinued.

Gauge—Standard vertical staff gauge ; read three times a week.

Channel—The bed is gravelly and the flow is in two channels during high water.

Discharge measurements—Are made by cable suspension from the bridge.

Winter flow—Open conditions usually prevail throughout the year.

Accuracy—C. Each year's results are independent of other years on account of shifting channel, which impairs accuracy.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1914				
July 11	262	2·7	6·24	715	May 3	537	4·65	7·53	2,500
Aug. 9	308	1·6	5·50	308	" 25	649	4·51	7·80	2,926
Sept. 18	180	1·4	5·27	253	July 8	306	3·45	6·07	750
Oct. 27	153	0·5	4·75	75	" 29	245	0·90	5·10	218
1912					1915				
May 2	270	2·3	6·02	640	Feb. 9	194	0·40	4·40	74[1]
" 25	471	4·4	7·42	2,090	May 5	233	3·27	5·86	760
July 4	288	2·6	6·31	760	June 2	299	3·40	6·30	1,020
" 23	267	1·1	5·50	374	" 8	265	3·52	6·19	943
Aug. 13	202	0·9	5·02	193	July 24	190	1·50	5·00	284
1913									
May 14	292	4·7	6·45	1,366					

[1] Partial ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
July....	......	......	......	......	......
Aug.....	......	......	......	......	......
Sept.....	......	......	......	......	......
Oct.....	......	......	......	......	......
Nov.....	......	......	......	......	......
Dec.....	......	......	......	......	......
1912					
Jan.....	310	60	127	0·08	0·09
Feb.....	190	145	169	0·11	0·12
Mar.....	230	130	157	0·10	0·11
April....	540	230	368	0·24	0·27
May....	2,580	600	1,502	1·00	1·15
June....	1,585	800	1,257	0·84	0·94
July....	870	220	514	0·34	0·39
Aug.....	210	85	165	0·11	0·13
Sept.....	160	40	84·5	0·06	0·07
Oct.....	115	40	62·4	0·04	0·05
Nov.....	160	50	95·3	0·06	0·07
Dec.....	145	50	66·1	0·04	0·05
Year....	2,580	40	380	0·25	3·44
1914					
Jan.....	490	82	198	0·13	0·15
Feb.....	130	82	102	0·07	0·07
Mar.....	218	130	183	0·12	0·14
April....	1,530	235	889	0·5[illegible]	0·66
May....	3,790	1,055	2,386	1·59	1·83
June....	3,060	1,170	1,718	1·14	1·27
July....	1,055	185	516	0·34	0·39
Aug.....	185	50	97	0·06	0·07
Sept.....	104	34	67	0·04	0·04
Oct.....	117	34	69	0·05	0·06
Period...	3,790	34	622·5	0·41	4·68

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
July...	1,060	350	677	0·45	0·52
Aug....	390	190	277	0·18	0·21
Sept....	270	145	184	0·12	0·13
Oct....	145	60	93·4	0·06	0·07
Nov....	160	40	85·3	0·06	0·07
Dec....	130	60	85·2	0·06	0·07
1913					
Jan....	46	29	33	0·02	0·02
Feb....	157	29	87	0·06	0·06
Mar....	125	46	84	0·06	0·07
April...	543	46	256	0·17	0·19
May...	2,915	353	1,318	0·88	1·01
June...	4,115	974	1,755	1·17	1·30
July...	932	174	504	0·34	0·39
Aug....	288	57	147	0·10	0·11
Sept....	228	42	109	0·07	0·08
Oct....	443	22	151	0·10	0·11
Nov....	157	67	97	0·06	0·07
Dec....	95	5	36	0·02	0·02
Period..	4,115	5	381	0·25	3·43
1915					
Jan....	......	......	......	......	......
Feb....	......	......	......	......	......
Mar....	......	......	......	......	......
April...	1,060	380	685	0·46	0·51
May...	1,260	650	932	0·62	0·71
June...	1,110	630	847	0·56	0·63
July...	650	265	394	0·26	0·30
Aug....	275	70	156	0·10	0·1
Sept....	70	42	55	0·04	0·[illegible]
Oct....	......	......	......	......	......
Period..	1,260	42	511	0·34	2·31

82—NICOLA RIVER—at Nicola

Drainage area, 1,300 square miles

DESCRIPTION OF GAUGING STATION

Location—At Nicola, below outlet of Nicola lake.

Records available—April 14 to Aug. 31, 1913; no record for 1914; Feb. 22 to Dec. 31, 1915; Feb. 1 to Dec. 31, 1916.

Co-operation—This station was established April 11, 1913, and maintained during 1913 by the Provincial Water Rights Branch. The station was taken over by the British Columbia Hydrometric Survey, February 10, 1915.

Gauge—Vertical staff ; read daily.

Channel—Rocky, permanent control ; high banks.

Discharge measurements—Ten measurements made by the Provincial Water Rights Branch in 1913, and eight measurements made by the British Columbia Hydrometric Survey subsequently, agree very well, and cover practically the whole range of stage except the peak of the freshet for 1913.

Winter flow—Partial ice conditions occur.

Accuracy—Results should be reliable, except at highest stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
April 14	49	0·94	0·42	46
" 14	49	0·86	0·43	42
" 16	44	0·95	0·4	42
" 19	48	0·96	0·5	46
" 24	56	1·14	0·6	64
" 28	62	1·61	0 8	100
May 1	58	1·29	0·72	75
" 3	69	1·67	0·9	115
" 13	79	2·10	0·11	166
" 20	103	3·12	1·7	322
1915				
Feb. 10	28	0·45	−0·40	13
May 5	35	3·60	0·97	126
June 9	108	6·00	2·2[illegible]	64[illegible]
July 26	116	1·88	1·30	219
Dec. 18	2[illegible]	0·80	0·20	22
1916				
June 2	71[illegible]	1·09	3·00	785
" 21	514	1·89	3·30	970
Sept. 23	71	0·67	0·46	48
1917				
Jan. 2[illegible]	15	0·98	0·10	15

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						**1914**					
May....	830	90	321	0·24	0·28	May...	......	......	......	......	......
June....	1,300	690	924	0·71	0·79	June...	......	......	......	......	......
July....	690	185	390	0·30	0·35	July...	......	......	......	......	......
Aug.....	180	55	100	0·08	0·09	Aug....	......	......	......	......	......
Period...	1,300	55	434	0·33	1·51	Period..	......	......	......	......	......
1915						**1916**					
Feb.....	......	......	......	......	......	Feb....	115	38	67	0·05	0·05
Mar.....	39	30	34	0·03	0·03	Mar....	230	100	180	0·14	0·16
April....	105	37	58	0·04	0·05	April...	190	135	160	0·12	0·13
May.....	810	115	325	0·25	0·29	May....	760	205	570	0·44	0·51
June.....	780	340	531	0·41	0·46	June...	1,020	760	730	0·56	0·63
July.....	340	195	250	0·19	0·22	July...	920	385	650	0·50	0·58
Aug.....	195	70	129	0·10	0·11	Aug....	365	115	225	0·17	0·20
Sept.....	70	28	44	0·03	0·04	Sept....	105	38	66	0·05	0·06
Oct......	33	20	27	0·02	0·02	Oct....	41	23	29	0·02	0·02
Nov.....	26	22	24	0·02	0·02	Nov....	25	15	18	0·01	0·01
Dec.....	30	24	27	0·02	0·02	Dec....	15	13	13	0·01	0·01
Period...	810	20	145	0·11	1·26	Period..	1,020	13	246	0·19	2·36

83—NORTH THOMPSON RIVER—at Black Pines

Drainage area, about 7,500 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Cooney's ranch, near Black Pines, about 18 miles above mouth. Sec. 23, tp. 22, rge. 17, W. 6th mer., above Heffley riffle.

Records available—April 1 to Dec. 30, 1912 ; April 13 to Dec. 31, 1913. Station abandoned ; new station at Barrière river.

Gauge—Chain gauge ; read daily.

Channel—Is about 400 feet wide ; water is 10 to 15 feet deeper at high than at low stages.

Discharge measurements—Rating curve is well defined, but considerable difficulty is encountered in securing meterings of maximum flow.

Winter flow—Stream is usually frozen from about Jan. 1 to April 1.

Accuracy—Is fairly high, considered to be within 10 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912					1913				
Feb. 9	4,230	0·5	10·0	2,120[1]	April 12	4,7[illegible]0	0·7	10·3	3,330
Mar. 12	4,020	0·39	....	1,560[1]	June 5	11,980	5·2	24·8	62,620
April 19	5,340	1·36	11·6	7,150	July 22	7,440	4·5	20·2	34,100
June 5	7,775	3·73	16·8	29,025					

[1] Ice conditions.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1912						**1913**					
April....	11,700	2,380	5,590	0·75	0·84	April[2]..	15,060	3,300	7,983	1·06	1·17
May....	49,960	12,440	32,757	4·37	5·04	May...	55,680	9,950	24,929	3·32	3·82
June....	47,760	25,350	38,722	5·17	5·77	June...	65,360	49,960	57,634	7·68	8·57
July....	30,120	24,100	27,027	3·61	4·16	July...	52,940	33,990	41,874	5·58	6·42
Aug.....	32,700	23,300	27,103	3·62	4·17	Aug....	41,160	30,980	35,821	4·78	5·50
Sept.....	27,540	7,540	16,675	2·22	2·48	Sept....	36,040	21,700	26,860	3·58	3·98
Oct.....	8,900	6,520	7,529	1·00	1·15	Oct....	22,900	15,820	18,766	2·50	2·88
Nov.....	6,180	2,060	3,707	0·49	0·55	Nov....	16,580	13,160	14,110	1·88	2·10
Dec.[1]....	....	....	2,084	0·28	0·19	Dec....	13,160	9,250	11,367	1·52	1·75
Period...	49,960	....	17,910	2·39	24·35	Period..	65,360	3,300	26,590	3·54	36·19

[1] For period Dec. 1 to 21. [2] Partly estimated.

* Considerable changes in the location of this river and its tributaries have been made on recent maps. In this estimate these changes have been taken into account.

84—NORTH THOMPSON RIVER—above Barrière river

Drainage area, about 7,000 square miles*

DESCRIPTION OF GAUGING STATION

Location—One mile above the mouth of Barrière river, 40 miles north of Kamloops.

Records available—June 1 to Dec. 31, 1915; April 1 to Dec. 31, 1916.

Gauge—Chain gauge on highway bridge; replaced on April 7, 1916, by vertical staff on downstream end of western pier of highway bridge.

Channel—Stream confined by bridge abutments and piers ; riffle near bridge and rapids ¼ mile below.

Discharge measurements—Are made from the highway bridge.

Winter flow—Ice conditions obtain during 3 or 4 months.

Accuracy—Considered reliable during open water season.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915				
Mar. 15	2,730	1·04	2·93	2,860
Aug. 13	4,840	4·15	10 93	20,100
Sept. 1	4,790	4·32	10·70	20,700
1916				
Mar. 28	2,934	1·20	3·63	3,488
April 6	3,141	1·48	4·16	4,661

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1916				
Mar. 28	2,934	1·20	3·63	3,490
April 6	3,141	1·47	4·16	4,660
May 18	4,760	3·98	9·87	18,950
June 19	7,542	7·56	18·00	56,900
July 23	6,403	5·60	14·60	[illegible]840
Sept. 1	4,571	3·42	9·45	[illegible]830

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
April....	....	....	....	....	....
May.....	....	....	....	....	....
June.....	27,250	19,200	22,660	3·23	3·60
July.....	28,800	22,800	24,210	3·45	3 98
Aug.....	25,400	19,200	21,230	3·03	3·49
Sept.....	20,200	6,060	10,460	1·50	1·67
Oct.....	10,000	4,600	6,490	0·93	1·07
Nov.....	9,040	3,850	5,428	0·78	0·87
Dec.[1]....	3,670	3,000	3,240	0·46	0·53
Period...	28,800	3,000	13,388	1·91	15·21

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1916					
April...	10,300	4,000	5,460	0·78	0·87
May...	26,100	11,500	20,000	2·86	3·30
June...	63,200	19,400	40,700	5·81	6·48
July...	48,800	26,100	38,000	5·43	6·26
Aug....	27,500	13,800	20,500	2·93	3·38
Sept....	18,600	7,680	11,600	1·66	1·85
Oct....	10,600	4,150	6,250	0·89	1·03
Nov.[2]..	4,750	....	3,500	0·50	0·56
Dec.[2]...	....	....	2,330	0·33	0·38
Period..	63,200	....	16,500	2·35	24·11

[1] Partly estimated ; ice conditions obtained after Dec. 18. [2] Estimates during ice conditions, made by comparison with discharges on South Thompson at Chase and Thompson at Spence Bridge.

85—OKANAGAN RIVER—below lake

Drainage area, 3,000 square miles†

DESCRIPTION OF GAUGING STATION

Location—In 1914, near Fairview ; in 1915, at the highway bridge, 300 ft. above Okanagan falls, near outlet of Dog lake.

Records available—April 8 to Dec. 31, 1914 ; Jan. to Dec., 1915 ; Mar. 18, to Dec. 31, 1916.

Gauge—Standard vertical staff ; read four times a week to March 12, 1915, and six times a week subsequently.

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* Possibly somewhat less ; measurements which take into account changes made in recent maps indicate an area of about 6,800 sq. miles.

† A determination of watershed from recent maps seems to indicate about 2,750 sq. miles.

Channel—Average width at Fairview measuring section, 75 feet ; bed of stream, gravel and sand, and constant shifting resulted. At the new station above falls, river narrows down from outlet of Dog lake, and is confined by bridge abutments to one channel at all stages ; gravel bed ; permanent rock control near falls below.

Discharge measurements—At Fairview ; were obtained at all stages of flow, and were well distributed throughout the season, thus making it possible to make adjustments for the change in area due to scouring. At new station, agree well and cover range of stage.

Winter flow—Partial ice conditions exist during January and February.

Accuracy—Considered fairly good, in spite of adverse conditions at first station. At second station accurate and reliable.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					1915				
April 7	276	1·90	0·71	524 [1]	Mar. 17	466	0·88	2·38	414 [2]
May 11	456	2·63	2·43	1,199	Mar. 26	467	0·86	2·37	402
June 5	520	2·76	3·28	1,436	April 11	486	0·96	2·50	468
July 17	454	2·51	2·27	1,138	June 7	688	1·47	3·40	1,020
Aug. 14	354	2·20	1·31	796	1916				
" 28	320	2·20	1·08	704	Mar. 18	385	0·75	2·14	287
Nov. 21	309	1·85	0·84	575	June 26	758	1·58	3·66	1,197
					Aug. 5	693	1·52	3·48	1,055
					" 29	594	1·40	3·08	820
					Nov. 18	391	0·66	2·10	259

[1] Near Fairview. [2] New station above falls.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......
1915					
Jan.	520	465	485	0·16	0·19
Feb.	442	420	433	0·14	0·15
Mar.	442	400	426	0·14	0·16
April	600	400	497	0·16	0·18
May	1,160	600	850	0·28	0·33
June	1,120	880	966	0·32	0·36
July	910	810	857	0·28	0·33
Aug.	840	660	737	0·25	0·29
Sept.	630	520	570	0·19	0·21
Oct.	520	460	473	0·16	0·18
Nov.	470	430	451	0·15	0·17
Dec.	460	400	429	0·14	0·16
Year	1,160	400	598	0·20	2·71

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
April	885	560	761	0·25	0·28
May	1,440	945	1,258	0·42	0·48
June	1,500	1,310	1,421	0·47	0·52
July	1,295	955	1,120	0·37	0·43
Aug.	900	695	792	0·26	0·30
Sept.	685	565	601	0·20	0·22
Oct.	630	575	598	0·20	0·23
Nov.	610	565	596	0·20	0·22
Dec.	595	485	540	0·18	0·21
Period	1,500	485	854	0·28	2·89
1916					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April	485	300	350	0·12	0·13
May	960	500	770	0·26	0·30
June	1,290	980	1,110	0·37	0·41
July	1,300	1,150	1,230	0·41	0·47
Aug.	1,130	770	970	0·32	0·37
Sept.	760	520	650	0·21	0·23
Oct.	520	315	410	0·14	0·16
Nov.	[illegible]	265	285	0·09	0·10
Dec.	265	265	265	0·09	0·10
Period	1,300	265	671	0·22	2·27

86—OTTERTAIL RIVER—near mouth

Drainage area, 90 square miles

DESCRIPTION OF GAUGING STATION

Location—5½ miles west of Field, just above the highway bridge on road from Field to Ottertail (old C.P. Ry. grade).

Records available—June to Oct., 1912 ; May to Oct., 1913 ; station discontinued.

Gauge—Vertical staff gauge ; read two or three times a week.

Channel—Is straight for 50 yards above and below the section. The water is swift and there are riffles immediately above and below.

Discharge measurements—Are made from temporary footbridge by means of cable carrier. Measuring section is not very good.

Winter flow—The river is generally frozen from Nov. to April.

Accuracy—C ; infrequency of gauge readings impairs accuracy.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912					1913				
June 6	62	2·2	2·72	138	May 22	69·6	2·00	2·80	138
" 28	104	6·3	3·60	650	July 3	110·5	5·41	3·60	598
Aug. 12	91	4·5	3·25	408	" 28	104·5	4·70	3·50	491
Nov. 19	38·6	1·84	2·48	71	" 31	93·5	3·60	3·30	337
					Aug. 29	91·0	3·70	3·25	337
					Dec. 1	56·2	1·27	2·40	71

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1912						1913					
May....	....	....	....	....	....	May...	930	40	178	1·98	2·28
June....	880	100	542	6·02	6·72	June...	1,350	490	829	9·21	10·3
July....	650	410	524	5·82	6·70	July...	740	290	523	5·81	6·75
Aug.....	960[1]	410	513	5·70	6·56	Aug....	740	200	435	4·83	5·57
Sept.....	475	151	291	3·23	3·60	Sept....	570	145	269	2·99	3·34
Oct.....	151	42	121	1·34	1·54	Oct....	145	85	115	1·28	1·48

[1] At 5 p.m. on Aug. 24, 1912, discharge was 1,120 sec.-ft.

87—OYSTER RIVER—near mouth

Drainage area, 70 square miles

DESCRIPTION OF GAUGING STATION

Location—One mile from mouth, upstream side of Island highway bridge, 18 miles from Courtenay.

Records available—June 1, 1914, to Dec. 31, 1916.

Gauge—12-foot enamel staff, nailed to cribbing on right bank, 20 feet downstream from bridge ; read twice daily.

Channel—Straight for 100 feet upstream and 400 feet downstream ; gravel bed ; channel may shift each year. Control changed in fall of 1915.

Discharge measurements—Taken from bridge ; extreme low water measurements taken 1,000 feet upstream from bridge.

Winter flow—Open all year as a rule, but was frozen over during Jan. and Feb., 1916.

Accuracy—In 1914, between discharge of 80 and 1,400 sec.-ft., accuracy B, above discharge of 1,400 sec.-ft., accuracy C; in 1915, accuracy B; in 1916, accuracy C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					Sept. 26	38	0·79	0·52	29·9[4]
June 1	298	3·5	2·70	1,040[1]	Oct. 28	656	7·56	5·50	4,960
July 18	262	2·6	2·10	689	" 29	408	4·36	3·85	1,780
Sept. 5	66	1·3	0·92	86·6[2]	1916				
Nov. 11	358	3·9	3·50	1,380	April 13	262	3·42	2·95	896[5]
1915					Oct. 26	20	1·71	1·30	35[6]
April 21	240	2·80	2·45	666[3]					

[1] Station established. [2] Low water section. [3] Channel shifted since 1914. [4] Not at regular section. [5] No gauge reader. [6] Gauge height affected by channel change.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug.....	....	....	....	....	....
Sept.....	....	....	....	....	....
Oct.....	....	....	....	....	....
Nov.....	....	....	....	....	....
Dec.....	....	....	....	....	....
Period..	....	....	....	....	....
1915					
Jan.....	1,160	140	444	6·34	7·31
Feb.....	1,000	240	512	7·31	7·61
Mar.....	2,020	215	703	10·04	11·58
April....	2,300	370	785	11·21	12·51
May....	965	270	643	9·19	10·59
June....	680	190	360	5·14	5·74
July....	240	100	153	2·19	2·52
Aug.....	100	65	72	1·03	1·19
Sept.....	65	35	49	0·70	0·78
Oct.....	4,690	35	783	11·19	12·89
Nov.....	1,280	450	689	9·84	10·98
Dec.....	2,600	110	895	12·79	14·74
Year....	4,690	35	507	7·24	98·44

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
June...	1,330	710	950	13·60	15·20
July...	1,080	340	700	10·00	11·50
Aug....	410	140	275	3·93	4·53
Sept....	1,470	90	350	5·00	5·58
Oct....	3,000	270	1,040	14·86	17·13
Nov....	2,170	540	1,280	18·29	20·42
Dec....	1,030	140	460	6·57	7·56
Period.	3,000	90	722	10·31	81·92
1916					
Jan [1]...	....	....	226	3·23	3·72
Feb....	....	....	175	2·50	3·70
Mar....	3,500	....	948	13·50	15·60
April [2]..	....	....	887	12·70	14·20
May....	....	....	1,000	14·30	16·50
June...	2,270	900	1,310	18·70	20·90
July...	1,750	500	897	12·80	14·80
Aug....	500	175	299	4·27	4·92
Sept....	215	70	136	1·94	2·16
Oct....	395	40	75	1·07	1·23
Nov....	395	135	253	3·61	4·03
Dec....	560	70	202	2·89	3·33
Year...	3,500	40	534	9·30	104·09

[1] Gauge height-discharge relation affected by ice and discharges estimated ; Jan. and Feb. as shown, Mar. 1 to 5. 200 c.f.s. [2] No gauge reader available April 8 to May 31, discharges estimated April 9 to 30, 860 c.f.s.; May as shown,

88—PEND-D'OREILLE RIVER*—near Waneta

Drainage area, 25,800 square miles†

DESCRIPTION OF GAUGING STATION

Location—9 miles above mouth.

Records available—May, 1913, to Sept., 1915 ; station discontinued.

Drainage area—In Montana, about 21,420 sq. miles ; in Idaho, about 2,000 sq. miles ; in Washington, about 1,210 sq. miles. Total in United States, 24,630 sq. miles. In British Columbia, 1,190 sq. miles. Total above mouth, about 25,820 sq. miles.

Gauge—Staff gauges are used ; read two or three times a week, except during high water, when they are read daily.

Channel—The Pend-d'Oreille through Canada is very swift, and there is no favourable metering section. The section chosen is very fast in high water, satisfactory at low stages, and appears to have a permanent control.

Discharge measurements—Are made from cable car.

Winter flow—In Canada the river seldom freezes over and frazil ice is not often a serious factor.

Accuracy—The gauge readings are somewhat infrequent, the stream is flashy during May and June. The measurements, except at low water, are only surface measurements. The results in May and June probably within 15 per cent, and, during the other months, 10 per cent. The discharge measurements and monthly summaries, given below for 1913 to 1915. have been recently revised and supersede all previously published data.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
June 11	11,500	11·46	25·20	132,000
" 25	11,100	10·50	24·20	117,000 [1]
July 15	8,230	8·24	17·13	67,900 [1]
Aug. 4	5,840	6·07	10·24	35,500 [1]
Sept. 2	4,440	4·35	5·41	19,300 [1]
Nov. 6	3,840	3·37	3·20	12,900
1914				
April 8	4,600	4·61	6·05	21,200
June 3	8,920	8·47	18·95	75,600
July 18	5,980	6·05	10·60	36,200
Nov. 12	4,500	4·61	5·60	20,700
1915				
Jan. 5	3,930	3·25	3·60	12,800
Feb. 12	3,500	2·78	1·95	3,600
Mar. 20	3,709	3·16	2·70	11,700
June 5	6,530	6·67	12·00	43,500
Aug. 10	5,000	4·84	7·54	24,200
Sept. 3	4,730	3·38	4·24	16,000

[1] Measurement by engineers of Provincial Water Rights Branch.

* See also records by the United States Geological Survey, in following chapter.

† This is a revised value based on recent measurements ; the area, as estimated by the B. C. Hydrometric Survey and used in preparing summaries below, is 26,600 sq. miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1914					
Jan.	12,900	9,850	12,000	0·45	0·52
Feb.	11,600	8,850	10,500	0·39	0·41
Mar.	19,000	11,800	15,200	0·57	0·66
April	41,600	18,100	28,300	1·06	1·18
May	76,600	43,000	58,400	2·19	2·52
June	77,000	53,800	67,400	2·53	2·82
July	53,100	26,200	38,900	1·46	1·68
Aug.	25,600	12,900	18,100	0·68	0·78
Sept.	12,600	10,400	11,200	0·42	0·47
Oct.	15,100	10,900	12,600	0·47	0·54
Nov.	21,700	16,000	20,000	0·75	0·84
Dec.	20,800	12,300	15,800	0·59	0·68
Year	77,000	8,850	25,700	0·97	13·10

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
June	129,000	95,400	117,000	4·40	4·91
July	101,000	39,000	66,100	2·48	2·86
Aug.	37,900	19,900	27,400	1·03	1·19
Sept.	19,600	12,600	15,500	0·58	0·65
Oct.	12,300	11,500	11,800	0·44	0·51
Nov.	14,000	12,000	12,900	0·49	0·54
Dec.	14,000	9,850	11,700	0·44	0·51
Period	129,000	9,850	37,486	1·41	11·17
1915					
Jan.	13,700	8,600	11,200	0·42	0·48
Feb.	9,700	9,100	9,300	0·35	0·36
Mar.	14,800	9,350	11,200	0·42	0·48
April	30,900	15,600	22,300	0·84	0·94
May	43,800	31,800	37,600	1·41	1·63
June	43,400	39,600	41,400	1·56	1·74
July	39,500	30,000	35,000	1·32	1·52
Aug.	29,700	18,100	23,600	0·89	1·03
Sept.	17,800	14,000	15,400	0·58	0·65
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	43,800	8,600	23,000	0·87	8·83

89—PHILLIPPS CREEK—near Roosville

Drainage area, 23 square miles

DESCRIPTION OF GAUGING STATION

Location—1,500 feet above road, near Roos ranch, Roosville.

Records available—May to Nov., 1914; April to Sept., 1915.

Co-operation—Provincial Water Rights Branch and B. C. Hydrometric Survey have co-operated.

Gauge—Wooden staff gauge; read daily.

Channel—Fairly uniform and smooth, but the bed of the stream is continually shifting and the stream is subject to severe freshets, which may completely change the channel.

Discharge measurements—5 were made in 1914; 4 in 1915.

Accuracy—Due to the nature of the stream, it is not possible to relate one year's results to another, and each year's measurements must be considered alone. Mean monthly discharges should be within 15 per cent.

General—Phillipps creek is a small but flashy mountain stream 10 to 15 miles long, flowing through a narrow draw, between two mountains, into Montana, about 4 miles from the mouth, and thence into Kootenay river. In places, it has a steep gradient and there is a fall above Roos ranch, which might be developed for power.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 16	23·3	3·36	1·80	78·4
June 17	23·65	4·06	1·85	96·1
July 10	14·6	2·21	1·40	32·2
" 27	13·3	1·35	1·20	18·0
Sept. 10	11·6	1·00	1·[illegible]0	12·7
1915				
April 24	18·4	2·44	1·50	44·9
May 13	21·7	2·97	1·60	64·5
June 15	20·8	2·73	1·55	56·8
Aug. 27	13·6	1·23	1·20	16·7
1916*				
July 28	....	....	0·94	58·7
" 28	....	....	0·92	45·0
Sept. 12	....	....	1·60	57·0
Oct. 7	....	....	1·28	34·8

* From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 352.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
	1914						1915				
April....	....	....	....	....	....	April	76 7	8 3	37 9	1 64	1 83
May....	106	33	69·6	3·02	3·48	May	92 7	50 6	70 0	3 04	3 50
June...	134	53	76·2	3 31	3·69	June .	113 0	56 5	78 0	3 40	3 79
July....	53	21·5	33·9	1·47	1 70	July .	106 0	35 1	50 9	2 60	3 00
Aug.....	33	12·0	17·0	0 74	0 85	Aug..	33 3	17 0	22 9	1 00	1 15
Sept....	18	12 0	14 0	0 61	0 68	Sept.	20 5	14 3	15 9	0 69	0 77
Oct....	25	15 0	19·0	0 83	0 96	Oct....	....	.	....	.	
Nov.	29	..	23·2	1 01	1·13	Nov.					..

90—POWELL RIVER—at lake outlet

Drainage area, 600 square miles

A description of the power development of the Powell River Co. is given on page 165. The company has for some years kept a record of the level of the lake—which is approximately 45 square miles in area—and also of the flow of the waste water over the dam, which is controlled by flashboards. No record, however, has been kept of the water actually used in the plant; consequently, without a study of the plant output, etc., it is not possible to do more than approximate the run-off from the watershed. From such records as are available it is estimated the average yearly run-off is from 4 to 6 second-feet per square mile. This vicinity is favoured with a moderate precipitation ; but further from the coast-line, the annual fall rapidly increases in amount (consult records).

As indicative of the flow conditions, the following summary is given for a portion of the year 1912. The discharge, as just stated, is artificially controlled by the dam and the summary given does not include the water used in the plant.

MONTHLY DISCHARGE OF POWELL RIVER AT DAM, FOR 1912.

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Jan.....	6,000	1,600	3,400	5·67	6·52	Aug....	3,360	850	1,863	3·10	3·57
Feb.....	5,400	2,520	3,975	6 62	7·13	Sept....	2,225	750	1,484	2 47	2·76
Mar.....	2,410	530	1,497	2·50	2·88	Oct....	2,425	1,150	1,766	2 94	3·39
April ...	1,080	350	748	1·25	1·40	Nov....	....	....	....	....	....
May....	4,470	970	2,975	4·96	5·71	Dec....	....	....	....	....	....
June....	3,770	3,060	3,390	5·65	6·30						
July....	3,325	600	1,495	2 49	2 87	Period..	6,000	350	2,260	3 77	42 53

Note—Flashboards were taken off Jan. 17. Flashboards were put on Mar. 26, April 18, April 22, May 29 and July 16.

Elevation of lake Jan. 1, 266.50 ; July 1, 267.60 ; Oct. 1, 267.92 ; Nov. 1, 268.38, datum being 100 feet below sea level.

91—PUNTLEDGE RIVER—near mouth

Drainage area, 275 square miles*

DESCRIPTION OF GAUGING STATION

Location—One mile from mouth, downstream side of highway bridge, 1 mile from Courtenay.

Records available—May 30, 1914, to Dec. 31, 1916.

Gauge—14-feet wooden staff, nailed to piling of right abutment of trussed span of railway bridge, downstream side ; read twice a day.

Channel—Straight for 800 feet upstream and 200 feet downstream ; even gravel bed ; one channel, except in extreme high water, when there is one small side channel. Control changed in Oct., 1915.

Discharge measurements—Are made from the bridge.

Winter flow—Open all year.

Accuracy—B. Change in control in Oct., 1915, made revision of 15 data necessary. The revisions are embodied in the monthly summary below.

* Revised value based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 30	463	5·3	3·58	2,450[1]
July 17	378	4·8	3·80	1,820
Sept. 4	159	2·9	1·80	457
Nov. 10	631	5·5	4·68	3,490
1915				
April 21	284	4·20	2·80	1,190
Sept. 26	155	2·27	1·45	352
Oct. 30	611	6·25	4·71	3,880
1916				
Mar. 16	576	5·98	4·43	3,440
April 14	462	5·55	3·88	2,560
Oct. 26	122	2·56	1·40	313

[1] Station established.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1915					
Jan.	1,570	570	901	3·28	3·78
Feb.	2,030	720	1,120	4·08	4·25
Mar.	4,070	880	2,030	7·39	8·52
April	3,890	1,420	2,470	8·98	10·02
May	1,340	1,150	1,260	4·58	5·28
June	1,280	810	1,030	3·75	4·18
July	810	440	605	2·20	2·54
Aug.	440	340	351	1·28	1·48
Sept.	465	320	344	1·25	1·40
Oct.	4,440	320	1,400	5·09	5·87
Nov.	3,680	1,310	1,770	6·44	7·18
Dec.	3,460	1,150	1,980	7·20	8·30
Year	4,400	320	1,270	4·62	62·80

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
June	2,250	1,570	1,840	6·69	7·46
July	2,310	800	1,400	5·09	5·86
Aug.	840	480	610	2·22	2·56
Sept	2,550	450	750	2·72	3·03
Oct.	13,000	680	3,950	14·36	16·55
Nov.	3,810	2,550	3,220	11·70	13·06
Dec.	3,180	510	1,380	5·02	5·77
Period	13,000	450	1,879	6·83	54·29
1916					
Jan.	1,120	492	700	2·54	2·93
Feb.	2,500	492	1,310	4·77	5·14
Mar.	3,850	850	2,350	8·55	9·86
April	2,910	1,080	1,670	6·07	6·77
May	3,590	1,770	2,780	10·11	11·65
June	4,190	2,630	3,260	11·86	13·24
July	3,060	1,020	2,290	8·34	9·62
Aug.	1,420	580	861	3·13	3·61
Sept.	675	465	541	1·97	2·20
Oct.	780	170	452	1·64	1·89
Nov.	1,040	465	578	2·10	2·34
Dec.	1,270	520	629	2·28	2·63
Year	4,190	170	1,450	5·28	71·88

92—PUNTLEDGE RIVER—at diversion dam — Drainage area, 250 square miles*

DESCRIPTION OF GAUGING STATION

Location—At diversion dam of Puntledge river, hydro-electric installation ; Canadian Collieries (Dunsmuir), Ltd.

Records available—June 7, 1913, to Dec. 31, 1916.

Co-operation—The data for this station were supplied by Canadian Collieries (Dunsmuir), Ltd.

Gauge—Wooden staff, located on right bank 50 feet above diversion dam.

Channel—Very even flow over crest of dam.

Discharge measurements—Daily discharges obtained by weir measurements over diversion dam plus water to flume.

Winter flow—Open all year.

Accuracy—The monthly summaries as given below are from revised data. Water diverted and flowing through flume is included.

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* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1913					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	......	......	......	......	......
June [1]	2,800	1,910	2,100	8·40	7·50
July	2,020	420	1,100	4·40	5·06
Aug.	600	360	385	1·54	1·78
Sept.	1,200	760	975	3·90	4·35
Oct.	1,200	500	900	3·60	4·14
Nov.	3,200	530	1,600	6·40	7·13
Dec.	2,900	1,000	1,850	7·40	8·52
Period	3,200	360	1,280	5·12	38·48
1915					
Jan.	1,080	400	639	2·56	2·95
Feb.	1,200	460	710	2·84	2·96
Mar.	2,600	530	1,360	5·44	6·25
April	2,500	720	1,600	6·40	7·14
May	1,250	800	1,100	4·40	5·07
June	1,250	1,000	1,100	4·40	4·90
July	1,100	300	608	2·43	2·80
Aug.	280	240	250	1·00	1·15
Sept.	280	210	252	1·01	1·13
Oct.	3,800	210	1,260	5·04	5·80
Nov.	3,500	1,040	1,490	5·96	6·65
Dec.	2,380	1,000	1,450	5·80	6·68
Year	3,800	210	985	3·94	53·48

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
Jan.	3,200	400	1,900	7·60	8·76
Feb.	880	420	520	2·08	2·17
Mar.	1,830	710	1,100	4·40	5·06
April	3,100	1,850	2,450	9·80	10·93
May	1,825	1,450	1,740	6·96	8·00
June	5,400	800	2,400	9·60	10·71
July	2,300	400	810	3·24	3·73
Aug.	400	240	300	1·20	1·38
Sept.	1,660	220	510	2·04	2·28
Oct.	5,800	360	2,800	11·20	12·90
Nov.	3,180	2,200	2,660	10·64	11·88
Dec.	2,600	350	1,100	4·40	5·06
Year	5,800	220	1,525	6·10	82·86
1916					
Jan.	1,260	480	664	2·66	3·07
Feb.	2,350	480	1,200	4·80	5·18
Mar.	3,760	720	1,840	7·36	8·48
April	2,950	850	1,420	5·68	6·34
May	2,870	1,140	2,080	8·32	9·59
June	2,480	1,880	2,210	8·84	9·86
July	2,520	500	1,350	5·40	6·23
Aug.	920	480	728	2·91	3·36
Sept.	480	400	455	1·82	2·03
Oct.	400	320	368	1·47	1·70
Nov.	480	360	422	1·69	1·89
Dec.	540	410	492	1·97	2·27
Year	3,760	320	1,102	4·41	60·00

[1] For period June 7 to 30.

93—ST. MARY RIVER—near Wycliffe

Drainage area, 825 square miles*

DESCRIPTION OF GAUGING STATION

Location—At traffic bridge near Wycliffe, 12 miles from the mouth and 7 miles from Cranbrook.

Records available—June to Dec., 1913; April to Dec., 1914; April to Sept., 1915, April to Sept., 1916.

Drainage area—825 sq. miles above gauging station; 1,000 sq. miles above mouth.

Gauge—Vertical staff gauge; read daily.

Channel—Straight, uniform, with smooth, swift water; good control.

Discharge measurements—Are made from the bridge. Rating curve is satisfactory.

Winter flow—St. Mary river freezes up in November or December and remains frozen till March. Frazil ice is prevalent.

Accuracy—The results should be within 10 per cent. Monthly summary given below for 1913 embodies revisions based on later measurements. See NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912				
Aug. 21	477	1·81	2·05	863
Dec. 2	345	1·36	1·1	458
1913				
June 14	1,281	8·34	6·8	10,673
" 25	1,077	5·83	5·5	6,273
July 21	785	3·81	3·9	2,986
Sept. 17	450	1·86	1·8	838
1914				
June 30	1,110	6·82	5·9	7,560
July 23	708	3·46	3·6	2,450
Oct. 10	454	1·93	1·9	878
Oct. 16	452	1·94	1·9	877
1915				
Feb. 21	493	1·32	Ice	651 [1]
May 27	665	5·85	4·6	3,890
June 12	570	5·10	4·0	2,910
1916				
Mar. 4	252	2·28	Ice	572 [1]
July 25	976	4·21	4·64	4,110
Aug. 16	761	2·20	2·70	1,680
Sept. 15	628	1·48	2·05	932
Oct. 4	509	1·36	1·85	690

[1] Ice conditions.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1913						1914		
April	....	....	....	....	....	April	2,400	395	1,470	1·78	1·98
May	....	....	....	....	....	May	9,240	2,220	5,530	6·71	7·73
June	19,800	3,810	10,742	13·05	14·57	June	17,100	7,240	9,550	11·58	12·87
July	5,030	3,010	3,612	4·38	5·05	July	11,600	1,590	5,420	6·57	7·57
Aug.	3,010	1,310	2,085	2·53	2·92	Aug.	1,590	767	1,050	1·27	1·46
Sept.	1,310	644	1,011	1·23	1·37	Sept.	767	767	767	0·93	1·04
Oct.	644	541	604	0·73	0·84	Oct.	836	590	711	0·86	0·99
Nov.	590	541	551	0·67	0·75	Nov.	910	910	910	1·10	1·26
Dec.	836	590	778	0·94	1·08	Dec.				....	....
			1915						1916		
April	4,790	1,270	2,330	2·83	3·16	April	2,800	1,400	1,570	1·90	2·12
May	6,210	3,010	3,970	4·82	5·55	May	6,640	2,110	3,880	4·71	5·43
June	5,800	2,940	3,740	4·54	5·05	June	37,900	4,560	13,400	16·25	18·13
July	3,900	2,000	2,520	3·06	3·53	July	14,500	3,010	7,670	9·30	10·72
Aug.	1,780	1,150	1,370	1·66	1·91	Aug.	3,010	1,310	1,720	2·08	2·40
Sept.	1,270	836	978	1·19	1·33	Sept.	1,310	836	1,080	1·31	1·46
Period	6,210	836	2,484	3·02	20·53	Period	37,900	836	4,890	5·93	40·28

94—**SETON CREEK**—below lake

Drainage area, 460 square miles

DESCRIPTION OF GAUGING STATION

Location—At foot bridge at Provincial hatchery, half-mile below Seton lake and 3 miles from Lillooet.

Records available—April 6, 1914, to Dec. 31, 1916.

Drainage area—460 sq. miles ; estimates differ ; another measurement gives about 600 sq. miles.

Gauge—Vertical staff on bridge pier ; read daily.

Channel—Shallow and strewn with boulders. The current is swift.

Discharge measurements—The measuring section, though about the best obtainable, is hardly an ideal one. The rating curve is fairly well defined.

Winter flow—Open water conditions all year.

Accuracy—C, in 1914 ; B, in 1915 ; C, in 1916 (D, above 2,490 sec.-ft.).

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
1914	*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
April 6	112	3·23	1·72	362 [1]	Aug. 6	190	5·45	2·75	1,040
June 13	231	6·73	3·30	1,556	Dec. 2	89	2·66	1·43	236
" 19	261	7·50	3·70	1,967	1916				
Sept. 17	134	3·64	2·20	488	June 26	580	4·11	4·10	2,380 [2]
1915					" 26	286	8·62	4·10	2,460 [3]
Feb. 13	85	2·78	1·43	236	Sept. 25	162	4·51	2·38	731 [4]
May 10	171	5·10	2·55	875	" 30	252	2·24	2·18	565 [5]
June 15	322	4·45	3·20	1,430	Dec. 9	209	1·20	1·37	250 [5]

[1] Station established. [2] Highway bridge at lake. [3] Regular section. [4] Bridge, 100 yds. above hatchery. [5] Bridge, 200 yds. below hatchery.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
									1914		
April	....	....	....	....	....	April	450	300	362	0·79	0·88
May	....	....	....	....	....	May	1,760	420	1,013	2·21	2·55
June	....	....	....	....	....	June	2,280	1,660	1,848	4·02	4·48
July	....	....	....	....	....	July	2,800	1,760	2,390	5·20	6·00
Aug.	....	....	....	....	....	Aug.	1,760	700	952	2·07	2·39
Sept.	....	....	....	....	....	Sept.	610	450	492	1·07	1·19
Oct.	....	....	....	....	....	Oct.	610	450	510	1·11	1·28
Nov.	....	....	....	....	....	Nov.	610	450	509	1·11	1·24
Dec.	....	....	....	....	....	Dec.	450	340	382	0·83	0·96
Period	....	....	....	....	....	Period	2,800	300	940	2·04	20·97

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1915						1916				
Jan.	300	230	[illegible]	0.60	0.69	Jan.	230	130	[illegible]	0.34	0.39
Feb.	230	230	230	0.56	0.52	Feb.	165	130	140	0.30	0.32
Mar.	230	200	215	0.47	0.54	Mar.	230	165	188	0.41	0.47
April	620	230	400	0.87	0.97	April	300	230	275	0.60	0.67
May	1,350	620	1,040	2.26	2.61	May	1,760	350	1,190	2.58	2.97
June	1,660	1,170	1,450	3.15	3.51	June	2,900	1,550	2,000	4.35	4.85
July	1,760	1,260	1,480	3.22	3.71	July	3,600	1,800	2,730	5.93	6.84
Aug.	1,440	1,000	1,120	2.44	2.81	Aug.	1,860	1,000	1,400	3.04	3.51
Sept.	1,080	350	587	1.28	1.43	Sept.	920	620	785	1.70	1.90
Oct.	350	200	260	0.56	0.65	Oct.	620	200	379	0.82	0.95
Nov.	300	230	255	0.56	0.62	Nov.	300	230	250	0.56	0.63
Dec.	350	230	270	0.59	0.68	Dec.	260	180	214	0.47	0.54
Year	1,760	200	632	1.37	18.74	Year	3,600	130	810	1.76	24.04

95—SEYMOUR CREEK—7 miles from mouth

Drainage area, 69 square miles

DESCRIPTION OF GAUGING STATION

Location—Above the Vancouver waterworks intake and about 7 miles from the mouth.

Records available—Nov., 1913, to Dec., 1916.

Co-operation—Gauge readings by Vancouver waterworks department.

Drainage area—Above intake, 69 sq. miles ; a revised estimate by the engineers of the Provincial Water Rights Branch.

Gauge—Vertical staff gauge, spiked to cribbing at intake ; read daily.

Channel—Rocks and boulders ; water swift at high stages.

Discharge measurements—Well define rating curve.

Winter flow—Usually open water all year, but may be affected by ice for short periods during exceptional weather.

Accuracy—B, except where records are affected by ice conditions.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1909					Aug. 14	157	0.47	0.60	73 [3]
Aug. 4	....	....	....	367	Oct. 15	355	1.9	2.00	600
" 16	....	....	....	210	" 20	588	3.9	3.20	2,290
1913					1915				
Nov. 6	133	....	1.60	282 [1]	April 14	364	1.90	2.23	710
1914					June 10	247	1.00	1.37	248
Jan. 6	662	6.7	4.20	4,450	Aug. 12	94	0.40	0.22	42 [3]
April 30	368	2.1	2.35	775	1916				
May 29	281	1.6	1.91	430	July 28	333	1.69	2.03	562

[1] Station established. [2] Backwater from small dam. [3] Not at regular section.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
							1914				
Jan.	......	......	......	......	......	Jan.	9,210	108	1,115	16.17	18.65
Feb.	......	......	......	......	......	Feb.	1,000	110	320	4.64	4.82
Mar.	......	......	......	......	......	Mar.	3,300	245	758	11.00	12.67
April	......	......	......	......	......	April	2,690	285	933	13.52	15.09
May	......	......	......	......	......	May	1,355	490	919	13.32	15.35
June	......	......	......	......	......	June	1,145	380	697	10.10	11.27
July	......	......	......	......	......	July	710	95	315	4.57	5.25
Aug.	......	......	......	......	......	Aug.	130	55	71	1.03	1.19
Sept.	......	......	......	......	......	Sept.	4,710	50	534	7.75	8.65
Oct.	......	......	......	......	......	Oct.	5,710	150	1,220	17.70	20.41
Nov.	......	......	......	......	......	Nov.	5,700	205	1,540	22.34	24.94
Dec.	......	......	......	......	......	Dec.	750	80	185	2.68	3.09
Period	......	......	......	......	......	Year	9,210	50	717	10.40	141.38

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1915						1916				
[illegible]	1,325	110	411	5.96	6.87	Jan.[1]	.....	.....	135	1.96	2.26
[illegible]	1,100	195	423	6.13	6.38	Feb.	11,400	70	1,150	16.70	18.00
Mar.	2,900	210	700	10.13	11.67	Mar.	3,950	180	973	14.10	16.30
April	7,750	270	1,184	17.17	19.16	April	1,400	390	706	10.20	11.40
May	1,020	210	540	7.82	9.02	May	1,750	390	882	12.80	14.80
June	425	100	214	3.10	3.46	June	2,150	665	1,190	17.30	19.30
July	150	55	88	1.27	1.46	July	2,350	530	991	14.40	16.60
Aug.	60	42	48	0.70	0.81	Aug.	530	102	260	3.77	4.35
Sept.	95	41	56	0.81	0.90	Sept.	150	58	74	1.07	1.19
Oct.	8,150	55	1,380	20.00	23.10	Oct.	1,750	50	183	2.65	3.06
Nov.	2,150	130	474	6.87	7.67	Nov.	3,000	110	494	7.16	7.99
Dec.	6,400	150	872	12.64	14.56	Dec.	2,600	80	271	3.93	4.53
Year	8,150	41	532	7.71	105.06	Year	11,400	50	609	8.84	119.78

[1] Ice conditions Jan. 11 to 19 and Jan. 23 to 31; discharge estimated.

96—SEYMOUR RIVER—near mouth

Drainage area, 250 square miles

DESCRIPTION OF GAUGING STATION

Location—Near the head of Seymour arm, about 1 mile from mouth.

Records available—Aug. 17 to Dec. 11, 1914 ; Mar. 8 to Dec. 31, 1915 ; April 28 to Dec. 31, 1916.

Gauge—Chain gauge suspended over river on a substantial pole ; read daily during freshet period and three times a week during the rest of season. Replaced by vertical staff April 28, 1916.

Channel—Rocks and gravel ; water swift.

Discharge measurements—Are made from cable car installed May 1, 1915 ; previous measurements from boat. Rating curve is well defined.

Winter flow—Ice conditions obtain during the winter months.

Accuracy—C during time chain gauge was in use ; this gave some trouble and discharges above 2,200 cubic feet per second are somewhat uncertain. For 1916, results are considered reliable, except at highest stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914					1916				
Aug. 15	427	2.45	2.37	1,051	April 28	514	4.50	4.15	2,290
1915					" 30	432	3.77	3.33	1,630
Mar. 17	284	2.10	1.65	605	June 15	775	5.70	6.00	4,410
May 1	471	2.56	3.22	1,680	July 13	784	5.00	6.47	5,260
" 13	568	3.60	3.65	2,040	Aug. 12	525	2.23	2.70	1,170
June 9	571	3.56	3.67	2,040	Sept. 15	394	1.72	1.78	680
" 10	495	3.21	3.25	1,590	Oct. 19	378	1.36	1.59	51[illegible]
July 18	583	3.60	3.90	2,140	1917				
" 25	497	3.02	3.04	1,510	Jan. 24	322	0.51	....	164
Oct. 8	294	1.44	1.22	425					

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
							1914				
Sept.	......	......	......	......	......	Sept.	1,630	420	760	3.04	3.3[illegible]
Oct.	......	......	......	......	......	Oct.	1,630	540	903	3.61	4.1[illegible]
Nov.	......	......	......	......	......	Nov.[1]	1,710	500	814	3.26	3.64
	1915						1916				
April	3,030	930	1,805	7.22	8.05	April	......	......	......	......	......
May	3,320	1,710	2,545	10.18	11.73	May	3,740	960	2,090	8.36	9.64
June	3,690	1,630	2,413	9.65	10.77	June	7,270	1,850	3,990	15.96	17.8[illegible]
July	3,520	1,470	2,093	8.37	9.64	July	5,530	1,690	3,300	13.20	15.2[illegible]
Aug.	1,550	730	1,082	4.33	4.98	Aug.	2,120	810	1,310	5.24	6.04
Sept.	910	360	605	2.42	2.70	Sept.	1,450	550	860	3.44	3.84
Oct.	1,110	390	708	2.83	3.26	Oct.	610	395	470	1.88	2.1[illegible]
Nov.	850	330	519	2.08	2.32	Nov.	590	395	480	1.92	2.1[illegible]
Dec.	420	280	351	1.40	1.61	Dec.[2]	530	200	340	1.36	1.57
Period	3,690	280	1,347	5.39	55.06	Period	7,270	200	1,610	6.42	58.[illegible]

[1] Ice conditions obtained after Dec. 13. [2] Ice conditions after Dec. 7; discharge estimated.

97—SHAWNIGAN CREEK—below lake — Drainage area, 22 square miles

DESCRIPTION OF GAUGING STATION

Location—500 feet from outlet of Shawnigan lake, upstream side of Esquimalt and Nanaimo Ry. bridge.

Co-operation—Provincial Water Rights Branch and B. C. Hydrometric Survey.

Records available—May 11, 1914, to Dec. 31, 1916.

Gauge—Nine-feet enam[illegible] staff, nailed to piling on left downstream side of highway bridge at outlet from l[illegible]; read daily.

Channel—Straight for 80 feet on each side of section ; gravel and sand bed ; one channel only.

Discharge measurement—1 in 1913 by Provincial Water Rights Branch ; 10 subsequently by B. C. Hydrometric Survey. Measurement of Dec. 11, 1916, made revision of rating curve necessary.

Winter flow—Open all year.

Accuracy—A up to discharge of 280 sec.-ft. ; B above. Monthly summary given below for 1914 embodies revisions based on later measurements. See NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					1915				
Jan. 27	95	....	.. ..	157.0[1]	Mar 22	44.8	0.90	2.20	41.1
1914					Aug. 27			0.23	0.0[4]
May 11	41	0.6	1.71	25.2[2]	Dec 7	104	2.58	4.59	268.0
July 5	11	0.3	1.05	3.3[3]	1916				
Aug 8	1	0.3	0.43	0.3	Mar. 21	95.2	2.45	4.29	233.0[6]
Sept. 16	......	......	0.00	0.0	Nov. 9	15.4	0.36	1.21	5.6[6]
Nov 24	98	2.5	4.33	245.0	Dec 11	68.7	1.24	3.03	84.9[6]

[1] On east side of E. & N. Ry. bridge. [2] Station established. [3] Several different sections used. [4] No flow. [5] At R.R. bridge. [6] At highway bridge.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
May	......	......	......	....	....
June	......	......	......	....	....
July	......	......	......	....	....
Aug	......	......	......	....	....
Sept	......	......	......	....	....
Oct	......	......	......	....	....
Nov.	......	......	......	....	....
Dec.	......	......	......	....	....
Period.	......	......	......	....	....
1915					
Jan.	105	52	106	4.82	5.56
Feb	89	55	73	3.32	3.46
Mar	55	37	46	2.09	2.41
April	58	28	46	2.09	2.33
May	28	14	19	0.86	0.99
June	14	6	9	0.41	0.46
July	5	2.2	3.26	0.15	0.17
Aug	2.3	0.1	1.02	0.05	0.06
Sept.	0.1	0	0.01	0.00	0.00
Oct	5	0	0.44	0.02	0.02
Nov.	265	9	75.3	3.43	3.83
Dec.	405	220	293	13.30	15.30
Year	405	0	56	2.54	34.59

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
May[1]	22	9	10.4	0.[illegible]	[illegible]
June	9	5	7.3	0.33	0.37
July	5	1.2	3.0	0.14	0.16
Aug.	1.2	0	0.2	0.09	0.10
Sept.	0	0	0	0.00	0.00
Oct.	20	0	6.5	2.96	3.30
Nov.	240	34	177	8.06	8.98
Dec.	265	52	110	5.00	5.76
Period	265	0	40.8	1.86	19.22
1916					
Jan	222	57	107	4.8[illegible]	5.62
Feb.	430	94	212	9.65	10.40
Mar	520	166	302	13.70	15.80
April	208	64	107	4.87	5.43
May.	64	18	37	1.68	1.94
June.	19	6	10	0.46	0.51
July.	7	3	4.4	0.20	0.23
Aug.	3	1.5	2.3	0.10	0.12
Sept.	1.5	0	0.7	0.03	0.03
Oct.	0.8	0	0.04	0.00	0.00
Nov	22	1.5	67	3.05	3.40
Dec	122	26	98	4.46	5.14
Year	520	0	79	3.58	48.62

[1] For period May 11 to 31.

98—SHUSWAP RIVER—at Enderby — Drainage area, 1,900 square miles*

DESCRIPTION OF GAUGING STATION

Location—At traffic bridge at Enderby.

Records available—Aug. 25 to Nov. 10, 1911 ; Mar. 1 to Dec. 31, 1912 ; April 1, 1913, to Dec. 31, 1915 ; Mar. 19 to Dec. 31, 1916.

Gauge—Standard vertical staff on highway bridge pile ; read daily.

Channel—Is straight for 100 yards at section; control is good; width of water surface at measuring section, 180 to 330 feet.

Discharge measurements—Are made from a boat, except during high water, when they are made from bridge.

Winter flow—Ice conditions prevail some years during January and February. During 1914, river remained open throughout.

Accuracy—B. Results are considered to be within 10 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
1911	*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
Aug. 25	2,120	0·9	4·08	1,950 [1]
Oct. 7	1,890	0·7	3·15	1,300 [1]
1912				
Feb. 28	1,680	0·4	1·90	590 [1]
May 20	4,970	2·3	10·65	11,400 [2]
June 16	5,550	2·4	12·06	13,100 [2]
July 13	3,760	1·7	7·34	6,270 [2]
Sept. 7	3,160	1·1	4·6	3,260 [2]
Oct. 5	1,710	1·0	3·55	1,720 [1]
1913				
May 13	2,570	2·2	7·55	5,610
June 5	7,016	2·6	14·60	18,700
Aug. 26	2,630	1·2	5·20	3,230
1915				
April 3	1,890	1·1	4·03	2,050
Sept. 8	1,900	0·9	3·70	1,690
1916				
Feb. 21	1,470	5·10	3·40	745 [3]
June 13	2,970	2·40	9·00	7,170
July 8	3,990	2·55	11·50	10,180
Sept. 11	2,030	1·06	4·34	2,150
Nov. 21	1,190	0·69	2·45	820
1917				
Jan. 22	1,580	0·33	....	520

[1] Cable station. [2] Bridge station. [3] Under ice cover.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	1,730	1,354	1,580	0·83	0·93
Oct.	1,460	940	1,160	0·61	0·70
Nov.[1]	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	5,660	603	2,712	1·43	1·60
May	14,300	4,150	7,250	3·82	4·40
June	21,800	13,400	17,443	9·18	10·25
July	13,600	5,380	9,106	4·80	5·52
Aug.	5,240	2,810	3,787	1·99	2·30
Sept.	3,160	2,180	2,773	1·46	1·63
Oct.	2,080	1,720	1,957	1·03	1·19
Nov.	1,980	1,560	1,746	0·92	1·03
Dec.	1,560	965	1,240	0·65	0·75
Period	21,800	603	5,335	2·81	28·67

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
Mar.	790	490	585	0·31	0·36
April	4,960	755	2,660	1·40	1·56
May	13,780	4,960	9,130	4·81	5·53
June	13,780	9,530	11,750	6·18	[illegible]·89
July	9,210	3,700	5,880	3·09	3·57
Aug.	3,600	2,400	2,900	1·52	1·75
Sept.	2,700	1,680	2,310	1·22	1·36
Oct.	1,780	1,440	1,615	0·85	0·98
Nov.	1,680	1,560	1,615	0·85	0·95
Dec.	1,540	1,030	1,260	0·66	0·76
Period	13,780	490	3,970	2·09	23·71
1917					
Jan.	1,375	937	1,055	0·56	0·64
Feb.	1,445	775	1,123	0·59	0·61
Mar.	1,020	724	843	0·44	0·51
April	4,345	1,020	2,822	1·49	1·66
May	10,000	4,540	7,887	4·15	4·77
June	12,000	8,695	10,486	5·52	6·15
July	9,880	3,520	7,189	3·78	4·36
Aug.	3,280	1,410	2,133	1·12	1·29
Sept.	1,560	1,210	1,285	0·68	0·76
Oct.	2,130	1,520	1,838	0·97	1·12
Nov.	2,480	1,845	2,187	1·15	1·28
Dec.	1,800	1,020	1,324	0·70	0·81
Year	12,000	724	3,348	1·76	23·96

[1] River frozen up Nov. 11, 1911, and ice went out Feb. 28, 1912.

* Revised value based on recent measurements.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1915					
Jan.	1,000	800	88[illegible]	0·46	0·[illegible]
Feb.	750	630	655	0·34	0·35
Mar.	1,190	630	836	0·44	0·51
April	5,630	1,260	3,536	1·86	2·08
May	10,700	5,770	8,737	4·60	5·29
June	10,100	7,170	8,286	4·36	4·86
July	9,700	5,910	7,881	4·15	4·77
Aug.	5,630	2,100	3,523	1·86	2·15
Sept.	2,050	1,340	1,628	0·86	0·96
Oct.	1,820	1,260	1,420	0·75	0·86
Nov.	1,910	1,260	1,626	0·86	0·96
Dec.	1,220	940	1,056	0·56	0·64
Year	10,700	630	3,339	1·76	23·96
1916					
Jan.	...	...	...	...	...
Feb.	...	...	...	...	...
Mar.	...	...	...	...	...
April	3,300	1,620	2,360	1·24	1·38
May	5,870	3,400	5,220	2·75	3·17
June	12,330	5,870	9,100	4·79	5·34
July	11,680	5,590	8,770	4·62	5·33
Aug.	5,320	2,240	3,470	1·83	2·11
Sept.	2,210	1,520	1,950	1·03	1·15
Oct.	1,510	930	1,170	0·62	0·71
Nov.	980	760	890	0·47	0·52
Dec.	760	600	670	0·35	0·40
Year	12,330	600	3,730	1·96	20·11

99—SHUSWAP RIVER—at Couteau falls

Drainage area, 760 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge below Couteau falls, near Lumby.

Records available—For years 1912, 1913 and 1914.

Co-operation—Records taken by Couteau Power Co. and C.N. Ry. engineers.

Gauge—Vertical staff gauge, with standard enamel facings; read daily.

Channel—Varies in width from 70 feet at low water to 150 feet at high water. The jamming of logs on a gravel bar below the gauge may occasionally cause backwater.

Discharge measurements—The company's engineer obtained a metering at every appreciable change of stage.

Accuracy—A. Great care is taken and accuracy is probably very high.

General—Charts showing the data obtained in 1912, 1913 and 1914 are given on Plate J. For description of proposed development on this river see page 173.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Jan.	...	...	...	...	...
Feb.	...	...	...	...	...
Mar.	...	...	...	...	...
April	...	...	...	...	...
May	...	...	...	...	...
June	...	...	...	...	...
July	...	...	...	...	...
Aug.	...	...	...	...	...
Sept.	...	...	...	...	...
Oct.	...	...	...	...	...
Nov.	...	...	...	...	...
Dec.	...	...	...	...	...
Period	...	...	...	...	...
1913					
Jan.	530	[illegible]	382	0·50	0·58
Feb.	478	[illegible]	412	0·54	0·56
Mar.	417	371	388	0·51	0·59
April	2,730	374	1,405	1·85	2·06
May	9,200	1,605	3,925	5·17	5·96
June	13,276	6,280	8,778	11·56	12·90
July	6,150	2,600	4,288	5·65	6·50
Aug.	2,374	1,470	2,070	2·72	3·13
Sept.	2,528	1,079	1,528	2·01	2·24
Oct.	1,350	900	1,139	1·50	1·73
Nov.	1,160	728	887	1·17	1·31
Dec.	710	455	541	0·71	0·82
Year	13,276	336	2,145	2·82	38·38
1912					
Jan.	383	272	327	0·43	0·49
Feb.	370	308	343	0·45	0·48
Mar.	426	298	335	0·44	0·51
April	2,084	458	1,447	1·90	2·12
May	7,377	2,070	4,680	6·16	7·09
June	7,800	3,697	5,764	7·58	8·46
July	3,815	1,750	2,805	3·70	4·26
Aug.	1,943	1,280	1,624	2·14	2·47
Sept.	1,534	775	1,204	1·58	1·76
Oct.	1,208	772	931	1·22	1·41
Nov.	865	746	799	1·05	1·17
Dec.	731	484	594	0·78	0·90
Year	7,800	272	1,738	2·29	31·12
1914					
Jan.	609	413	534	0·70	0·81
Feb.	490	408	441	0·58	0·60
Mar.	621	340	447	0·59	0·68
April	2,630	600	1,724	2·27	2·53
May	5,880	2,250	4,280	5·64	6·50
June	6,827	3,775	5,077	6·68	7·46
July	5,260	1,570	3,440	4·53	5·22
Aug.	1,555	790	1,164	1·53	1·76
Sept.	1,200	680	833	1·10	1·23
Oct.	1,460	1,100	1,248	1·64	1·89
Nov.	1,510	900	1,212	1·60	1·79
Dec.	900	450	605	0·80	0·92
Year	6,827	408	1,750	2·30	31·39

* Revised value based on recent measurements.

100—SILVERTON (FOUR-MILE) CREEK—below Hewitt mill

Drainage area, 41 sq. miles

DESCRIPTION OF GAUGING STATION

Location—At bridge, about 3 miles from mouth, near Silverton, and about ¼ mile below Hewitt mill.

Records available—May, 1914, to Dec., 1915.

Drainage area—40 to 50 sq. miles.

Gauge—Vertical staff, enamel ; read daily.

Channel—Swift water with rocky bed. Apparently permanent.

Discharge measurements—May not be very accurate.

Winter flow—The creek does not stay frozen for more than a few days at a time. Frazil and anchor ice may form at times.

Accuracy—Below discharge of 36 sec.-ft., uncertain; between 36 and 380 sec.-ft., B; above 380 sec.-ft., D.

General—This creek is used for mining purposes by Standard, Hewitt and Van Roi mines.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
1914	*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
April 19	42·0	3·97	0·85	171
May 12	63·5	4·69	1·20	298
June 11	57·2	4·81	1·15	275
" 18	95·6	5·01	2·10	479 [1]
July 9	66·0	4·30	1·25	283
Aug. 18	33·1	2·64	0·5	88
Nov. 3	32·5	3·12	0·5	101
1915				
Mar. 18	18·6	2·10	0·35	39
April 28	46·0	3·02	1·30	139
June 10	56·1	4·18	1·50	235
Sept. 9	24·6	2·16	0·80	54
Dec. 1	16·9	2·61	0·53	44
1916 [2]				
Mar. 14	....	....	0·40	23
April 11	....	....	0·70	52
May 10	....	....	1·35	186
Aug. 3	....	....	1·97	171
" 30	....	....	1·37	68
Sept. 1	....	....	1·30	70
" 25	....	....	1·40	72
Oct. 30	....	....	1·29	41

[1] Meter out of order. [2] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21, p.* 51.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
[illegible]					
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	494	190	328	8·00	9·22
June	758	312	475	11·59	12·94
July	455	140	268	6·54	7·54
Aug.	165	65	103	2·51	2·89
Sept.	136	59	91	2·23	2·50
Oct.	108	65	86	2·10	2·42
Nov.	133	52	77	1·88	2·10
Dec.	46	20	35	0·85	0·98
Period	758	20	183	4·47	40·50
1915					
Feb.	38	35	37	0·90	0·94
Mar.	44	37	39	0·95	1·10
April	254	43	127	3·10	3·46
May	480	180	270	6·58	7·58
June	431	208	270	6·58	7·34
July	254	180	208	5·07	5·84
Aug.	180	65	101	2·46	2·84
Sept.	71	51	64	1·56	1·74
Oct.	71	51	63	1·54	1·78
Nov. [1]	71	45	55	1·34	1·50
Dec.	45	38	41	1·00	1·15
Period	480	35	116	2·83	35·27

[1] Partly estimated.

101—SILVERTON (FOUR-MILE) CREEK—above Hewitt intake

Drainage area, 30 square miles

DESCRIPTION OF GAUGING STATION

Location—Immediately above Hewitt intake, about 5 miles from Silverton, at mouth.

Records available—April 24, 1914, to Dec., 1915.

Gauge—Vertical staff, enamel ; read daily.

Channel—Water smooth and swift ; controlled by Hewitt diversion dam.

Discharge measurements—Made by wading.

Accuracy—No high water measurements have been made. The gauge readings in 1914 were somewhat intermittent. The results in 1914 may not be closer than 20 per cent. In 1915 the results should be better.

General—Granite creek flows in below this station and above the station situated below Hewitt mill

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
April 19	62·7	1·27	1·05	80·1
June 11	55·0	3·55	1·52	195·0[1]
July 9	57·8	3·56	1·58	205·0
Aug. 18	26·9	1·86	0·8	50·1
Nov. 3	22·6	2·09	0·8	47·4
1915				
Mar. 18	16·3	0·93	0·75	15·1
April 28	41·0	1·96	1·05	80·4
June 9	49·5	2·70	1·38	133·0
Sept. 9	26·4	1·32	0·64	34·8
Dec. 1	46·4	0·67	Ice	31·4[2]
1916[3]				
May 10	....	....	1·25	114·0
Aug. 2	....	....	1·28	120·0
Sept. 25	....	....	0·89	46·1
Oct. 30	....	....	0·39	22·7

[1] Different section. [2] Ice conditions. [3] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 351.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	381	60	234	7·80	8·99
June	430	157	290	9·66	10·8
July	226	71·5	148	4·93	5·68
Aug.	71·5	48	62·4	2·08	2·40
Sept.	69·2	26·2	46·1	1·54	1·72
Oct.	57·6	31·7	40·3	1·34	1·54
Nov.	60	26·2	36·6	1·22	1·36
Dec.[1]	26·2	12·5	18·8	0·63	0·73
Period	430	12·5	110	3·67	33·22
1915					
Jan.	15·5	15·0	15·3	0·51	0·59
Feb.	15·1	15·0	15·1	0·50	0·52
Mar.	16·0	14·8	15·1	0·50	0·58
April	131	15·6	68·4	2·28	2·54
May	206	105	144	4·80	5·53
June	172	121	141	4·70	5·24
July	157	92·1	123	4·10	4·73
Aug.	88·6	34·5	54·2	1·81	2·09
Sept.	39·6	23·0	28·5	0·95	1·06
Oct.	39·6	20·8	27·6	0·92	1·06
Nov.	31·5	16·2	21·7	0·72	0·80
Dec.	16·2	15·0	15·4	0·51	0·59
Year	206	14·8	56	1·87	25·33

[1] Ice conditions obtained Dec. 13 to 21.

102—SIMILKAMEEN RIVER—near Ashnola

Drainage area, 2,[illegible] square miles*

DESCRIPTION OF GAUGING STATION

Location—Near Ashnola, below Ashnola creek.
Records available—April 8, 1914, to Dec. 31, 1916.
Gauge—Standard vertical staff gauge; read daily. Datum lowered 1 foot on Mar. 8, 1916.
Channel—Is straight at section, width 125 to 235 ft.; bed very rocky and water turbulent even at low stages.
Discharge measurements—Rating curve well defined.
Winter flow—Partial ice conditions exist for short periods in cold winters.
Accuracy—Good.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
Apr. 8	552	3·41	1·35	1,881
May 10	1,097	6·69	5·92	7,326
June 10	913	5·14	3·10	4,697
" 24	856	4·51	2·75	3,870
July 29	382	2·24	0·30	858
Aug. 30	261	1·38	−0·47	360
Nov. 23	375	2·04	0·20	764
1915				
April 6	550	3·97	1·40	2,165
June 6	729	4·90	2·60	3,560
1916				
Mar. 8	300	1·64	0·97	49[illegible]
May 31	1,230	7·75	5·60	9,[illegible]
June 28	1,615	8·70	7·30	14,000
Aug. 3	585	3·63	2·50	2,120
" 31	350	2·30	1·15	802
Nov. 17	207	1·80	0·50	374
1917				
Jan. 20	225	1·22	0·30	274

[1] Gauge datum lowered 1 foot.

* Revised value, and includes watershed area of Ashnola creek.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
									1914		
April						April[1]	4,305	1,880	3,101	1·07	0·91
May						May	15,525	3,870	8,960	3·09	3·56
June						June	12,945	3,770	6,839	2·36	2·63
July						July	4,185	795	1,993	0·69	0·79
Aug.						Aug.	795	330	542	0·19	0·22
Sept.						Sept.	720	318	469	0·16	0·18
Oct.						Oct.	720	462	578	0·20	0·23
Nov.						Nov.	1,009	624	786	0·27	0·30
Dec.						Dec.	755	160	447	0·15	0·17
Period						Period	15,525	160	2,635	0·9[illegible]	9·27
			1915						1916		
Jan.	450	190	343	0·12	0·14	Jan.	320	300	300	0·10	0·12
Feb.	340	220	308	0·11	0·11	Feb.	790	310	465	0·16	0·17
Mar.	770	310	453	0·16	0·18	Mar.	2,620	580	1,190	0·41	0·47
April	5,790	700	2,644	0·91	1·02	April	6,250	1,070	2,520	0·87	0·97
May	5,570	2,445	3,918	1·35	1·56	May	13,600	4,800	8,140	2·81	3·24
June	3,580	1,500	2,422	0·84	0·94	June	20,550	8,300	12,490	4·31	4·81
July	1,710	910	1,293	0·45	0·52	July	10,600	2,400	5,790	2·00	2·31
Aug.	1,660	400	745	0·26	0·30	Aug.	2,220	710	1,340	0·46	0·53
Sept.	520	260	404	0·14	0·16	Sept.	1,210	460	660	0·23	0·26
Oct.	1,940	375	694	0·24	0·28	Oct.	520	400	440	0·15	0·17
Nov.	1,400	400	675	0·23	0·26	Nov.	490	320	395	0·14	0·16
Dec.	570	340	476	0·16	0·18	Dec.	380	255	330	0·11	0·13
Year	5,790	190	[illegible]	0·41	5·65	Year	20,550	255	2,830	0·98	13·34

[1] For period April 8 to 30.

103—SKAGIT RIVER—above international boundary — Drainage area, 356 square miles

DESCRIPTION OF GAUGING STATION

Location—4 miles from international boundary, 40 miles from Hope.
Records available—Mar. 27 to Dec. 31, 1915.
Gauge—Gurley automatic.
Channel—Fine gravel; good control; width about 150 feet.
Discharge measurements—Well define rating curve.
Winter flow—Ice conditions exist during the winter months.
Accuracy—C. Gauge was out of order for a short period.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					1916[1]				
Mar. 14	228	0·80	8·92	193	Jan. 10			9·03	280
" 26	379	1·68	9·80	635	Mar. 31			10·25	975
May 30	454	2·40	10·48	1,099	Aug. 14			10·22	869
Oct. 26	370	1·93	9·99	714	" 15			10·20	859
" 28	480	2·60	10·65	1,250					

[1] From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 132.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
									1915		
April						April	1,240	820	974	2·73	3·05
May						May	1,065	760	924	2·59	2·99
June						June	1,135	615	850	2·38	2·65
July						July	670	425	508	1·43	1·65
Aug.						Aug.	470	230	331	0·93	1·07
Sept.						Sept.	240	50	136	0·38	0·42
Oct.						Oct.	1,305	50	430	1·21	1·40
Nov.						Nov.	1,210	345	598	1·68	1·87
Dec.						Dec.	665	260	426	1·20	1·38
Period						Period	1,305	50	575	1·61	16·48

104—SKEENA RIVER—near Hazelton

Drainage area, about 9,200 square miles

DESCRIPTION OF GAUGING STATION

Location—At ferry at Old Hazelton, ¼ mile above the mouth of Bulkley river.

Records available—July 16 to Dec. 31, 1915.

Gauge—Chain gauge on long pole braced over left bank near ferry ; read daily.

Channel—Straight above and below section. Bed is permanent and current swift. At high stages, only surface velocities can be obtained.

Discharge measurements—4 well distributed measurements during open season 1915.

Winter flow—River usually freezes over early in December. Winter flow is affected by ice jams near confluence with Bulkley river.

Accuracy—Below gauge height of 5.0, results should be within 15 per cent ; above 5.0, within 20 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1915					1916*				
July 16	4,460	6·32	5·55	28,200	Mar. 13	...	...	-0·70	2,190[1]
Aug. 28	3,340	4·99	3·00	16,550	April 21	...	...	1·87	4,300
Sept. 25	2,190	3·27	0·20	7,150	May 13	...	...	3·05	15,500
Oct. 23	3,490	5·24	3·40	18,280					

* From "Miscellaneous Meter Measurements," *W. R. Paper No. 31*, p. 356. [1] Ice.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1915					
Aug.	...	...	...	...	...	Aug.[1]	36,000	17,400	25,600	2·78	3·[illegible]
Sept.	...	...	...	...	...	Sept.	19,040	7,160	12,000	1·31	1·46
Oct.	...	...	...	...	...	Oct.	52,720	8,300	18,400	2·00	2·31
Nov.	...	...	...	...	...	Nov.	13,520	6,120	8,460	0·92	1·03
Dec.	...	...	...	...	...	Dec.	6,120	5,640	5,850	0·64	0·74
Period	...	...	...	...	...	Period	52,720	5,640	14,062	1·53	8·74

[1] Maximum flow July 16 to 31 was on July 22 ; gauge height, 9·5 ; estimated discharge, 47,920 second-feet.

105—SLOCAN RIVER—near mouth

Drainage area, 1,300 square miles.*

DESCRIPTION OF GAUGING STATION

Location—About 1 mile from mouth, on highway bridge near Crescent Valley.

Records available—Dec., 1912, to Dec., 1915.

Gauge—Vertical staff gauge, fastened to the bridge cribbing ; read daily.

Channel—Straight above and below the section, and inclined to shift. One side of the channel is often filled with logs. The control is not satisfactory.

Discharge measurements—Are made from the highway bridge.

Accuracy—This station, particularly at the higher stages, is not considered satisfactory. The channel is frequently obstructed by log booms or jams, and is inclined to shift. It is hoped that further discharge measurements and a careful analysis of the records will enable a satisfactory revision to be made. The summaries given below, therefore, must be regarded as approximate only, especially at the higher stages.

General—The results obtained at this station, in conjunction with those obtained on the Kootenay river at Glade, are utilized in rating the gauging stations at Bonnington Falls and at Nelson. Errors in the rating of this station will therefore be reflected in the derived ratings for the Kootenay river at Bonnington Falls and Nelson, though to a reduced degree, owing to the fact that the discharge of the Slocan river forms a relatively small proportion of the discharge of the Kootenay below their confluence.

* Revised value based on recent measurements.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					May 5	1,170	4·56	6·75	5,340[1]
Nov. 8	652	2·47	4·40	1,600	June 3	1,450	3·75	7·80	5,420[1]
1914					July 30	1,300	3·49	6·50	4,540[1]
Mar. 6	470	1·91	3·45	897	1916*				
May 30	1,470	5·43	8·10	7,980	June 7	....	....	7·70	8,040
Aug. 13	845	3·01	5·10	2,540	July 3	....	....	10·60	14,350
Nov. 10	579	4·11	4·82	2,380	Aug. 5	....	....	5·86	4,270
Dec. 9	468	2·62	3·95	1,230	Sept. 5	....	....	4·52	2,310
1915					" 27	....	....	3·97	1,580
Feb 24	339	2·07	3·10	703[1]	Nov. 29	....	....	3·10	860

[1] Logs in channel. * From "Miscellaneous Meter Measurements," *W. R. Paper No. 21*, p. 351.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1912						1913					
Jan.	....	....	....	....	....	Jan.	780	530	655	0·50	0·58
Feb.	....	....	....	....	....	Feb.	850	430	640	0·49	0·51
Mar.	....	....	....	....	....	Mar.	630	280	455	0·35	0·40
April	....	....	....	....	....	April	4,230	350	2,290	1·76	1·97
May	....	....	....	....	....	May	16,200	3,360	9,760	7·51	8·64
June	....	....	....	....	....	June	22,000	10,000	16,000	12·31	13·74
July	....	....	....	....	....	July	10,500	4,230	7,370	5·67	6·52
Aug.	....	....	....	....	....	Aug.	4,140	2,600	3,370	2·59	2·99
Sept.	....	....	....	....	....	Sept.	3,900	2,350	3,120	2·40	2·68
Oct.	....	....	....	....	....	Oct.	2,350	1,600	1,980	1·52	1·75
Nov.	....	....	....	....	....	Nov.	1,700	1,320	1,520	1·17	1·31
Dec.	950	700	825	0·63	0·73	Dec.[1]	950	700	825	0·63	0·73
Year	....	....	....	....	....	Year	22,000	280	4,000	3·08	41·82
1914						1915					
Jan.	2,090	850	1,260	0·97	1·12	Jan.	800	700	755	0·58	0·67
Feb.	1,240	970	1,050	0·81	0·84	Feb.	700	700	700	0·54	0·56
Mar.	1,340	750	1,040	0·80	0·92	Mar.	850	700	754	0·58	0·67
April	4,950	1,340	3,280	2·52	2·81	April[2]	....	....	....	....	....
May	8,120	3,980	6,360	4·89	5·64	May	....	....	....	....	....
June	11,700	6,390	8,170	6·29	7·02	June	....	....	....	....	....
July	8,120	3,500	6,150	4·73	5·45	July	....	....	....	....	....
Aug.	2,780	1,340	2,050	1·58	1·82	Aug.	....	....	....	....	....
Sept.	1,650	1,240	1,390	1·07	1·19	Sept.	....	....	....	....	....
Oct.	2,320	1,440	1,590	1·22	1·41	Oct.	850	800	811	0·62	0·72
Nov.	2,550	1,440	1,840	1·42	1·58	Nov.	850	800	820	0·63	0·70
Dec.	1,440	750	989	0·76	0·88	Dec.	800	750	773	0·59	0·68
Year	11,700	750	2,931	2·26	30·68	Period	....	....	....	....	....

[1] Figures for Dec. are for 1912. [2] Results for the higher stages in 1915 are withheld for further study.

105a—SLOCAN RIVER—at Slocan

Drainage area, 710 square miles

DESCRIPTION OF GAUGING STATION

Location—At the outlet of Slocan lake at Slocan.

Records available—April 1 to December 31, 1916.

Gauge—Vertical staff, nailed to pile at end of C.P. Ry. wharf on Slocan lake. The gauge is about 200 yards above the metering section.

Channel—Uniform, with smooth flow ; control good.

Discharge measurements—2 in 1915 and 8 in 1916.

Winter flow—Ice conditions not severe ; lake is open for navigation throughout the year.

Accuracy—Between discharges 0 to 4,000 sec.-ft., A ; 4,000 to 9,000 sec.-ft., B ; 9,000 to 14,000 sec.-ft., D.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1915					June 28	2,265	4·14	8·10	9,300
Mar. 25	508	0·90	0·50	460	July 15	1,820	3·65	6·65	6,630
July 29	1,110	2·64	3·75	2,930	Aug. 4	1,140	2·90	3·92	3,320
1916					" 29	867	2·10	2·35	1,820
Mar. 13	526	1·13	0·09	592	Sept. 26	678	1·71	1·62	1,160
May 8	1,150	2·69	3·78	3,100	Nov. 1	577	1·13	0·90	652

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
April..	....	....	....	....	....
May....	....	....	....	....	....
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
Nov....	....	....	....	....	....
Dec....	....	....	....	....	....
Period.	....	....	....	....	....

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1916		
April...	1,510	700	1,040	1·46	1·63
May...	3,160	1,690	2,310	3·25	3·75
June...	11,400	3,280	6,640	9·35	10·40
July...	8,800	3,480	6,360	8·82	10·20
Aug....	3,370	1,690	2,430	3·42	3·94
Sept....	1,690	1,430	1,600	2·25	2·51
Oct.[1]....	....	....	1,100	1·55	1·79
Nov....	1,030	530	630	0·89	0·99
Dec....	530	385	464	0·65	0·73
Period	11,400	385	2,497	3·51	35·96

[1] Owing to change in gauge readers no readings were obtained during October. Mean monthly discharge estimated by interpolation

106—SOUTH SIMILKAMEEN RIVER—near mouth

Drainage area, 750 square miles*

DESCRIPTION OF GAUGING STATION

Location—Near mouth at Princeton.

Records available—May 14 to Dec. 19, 1914 ; Mar. 22 to Nov. 30, 1915 ; Mar. 27 to Nov. 12, 1916.

Gauge—Standard chain gauge on the highway bridge ; read daily.

Channel—Average width at measuring section about 170 feet. Bed, gravel, with a few boulders.

Discharge measurements—Are made with cable and 30 lb. weight. The rating curve is well defined. Change in control occurred on June 14, 1916.

Winter flow—Partial ice conditions exist during winter months.

Accuracy—Good, considered reliable, except at highest stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914				
May 13	476	7·33	3·88	3,490
June 15	511	6·25	4·00	3,194
" 22	380	4·74	3·31	1,799
July 27	117	3·58	1·88	419
Sept. 2	145	1·02	1·23	149
Nov. 28	121	3·19	1·83	386
1915				
April 7	120	4·88	2·26	588
June 5	573	2·56	2·92	1,167
1916				
June 27	763	8·00	5·60	6,080
July 15	484	4·40	4·00	2,130
Aug. 4	310	3·00	2·92	930
" 30	155	2·30	2·25	356
Nov. 16	86	0·75	1·70	66
1917				
Jan. 12	76	1·43		109

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
June....	....	....	....	....	....
July....	....	....	....	....	....
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
Nov...	....	....	....	....	....
			1915		
April....	1,710	180	927	1·24	1·38
May....	2,270	850	1,505	2·01	2·32
June....	1,630	500	928	1·24	1·38
July....	570	280	407	0·54	0·62
Aug....	440	150	236	0·31	0·36
Sept....	180	98	142	0·19	0·21
Oct....	530	125	223	0·30	0·35
Nov....	365	150	277	0·37	0·41
Dec....	....	....	....	....	....
Period...	2,270	98	581	0·77	7·03

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1914		
June...	6,037	1,337	2,544	3·39	3·78
July...	1,839	345	871	1·16	1·34
Aug....	335	144	235	0·31	0·36
Sept....	267	135	195	0·26	0·29
Oct....	275	165	201	0·27	0·31
Nov.[1]..	455	217	312	0·42	0·47
			1916		
April..	2,270	540	820	1·09	1·22
May..	6,700	1,550	3,450	4·60	5·30
June..	11,340	3,530	6,340	8·45	9·43
July...	5,150	1,060	2,610	3·48	4·01
Aug....	1,110	340	640	0·85	0·98
Sept....	580	200	300	0·40	0·45
Oct....	170	120	150	0·20	0·23
Nov.[2]..	170	65	115	0·15	0·17
Dec.[2]...	....	....	100	0·13	0·15
Period..	11,340	65	1,610	2·15	21·94

[1] Ice conditions obtained after Dec. 19, therefore no summary is given for Dec. [2] Estimated Nov. 13 to Dec. 31.

* Revised value based on recent measurements.

107—SOUTH THOMPSON RIVER—at Chase — Drainage area, 7,000 square miles*

DESCRIPTION OF GAUGING STATION

Location—At wharf of Adams River Lumber Co. at outlet of Little Shuswap lake, Chase. Sec. 35, tp. 21, rge. 13, W. 6th mer.

Records available—April 22 to July 31, 1911 ; April 10 to Dec. 31, 1912 ; April 12 to Dec. 31, 1913 ; Jan. 1 to 27 and Mar. 24 to Dec. 31, 1914 ; Jan. 1 to Dec. 31, 1915 ; Jan. 1 to Dec 31, 1916.

Co-operation—Gauge readings by Adams River Lumber Co. in 1911.

Gauge—Vertical staff gauge fixed to pile ; read daily ; also chain gauge for winter use.

Channel—Above the measuring section, river broadens out into Little Shuswap lake. Below section, river is straight for 200 yards, width about 500 feet

Discharge measurements—Are made from cable and boat. Rating curve well defined.

Winter conditions—Except during severe winters the river remains partially open throughout the year. Very little ice forms at the Chase riffle, which forms control for station. Gauge height discharge relation is practically unaffected.

Accuracy—Results considered reliable and accurate at all stages and at all times of the year.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911					1915				
Oct. 20	4,450	1·30	3·46[1]	5,780	Feb. 24	3,630	0·69	2·30	2,510
1912					April 20	4,570	1·70	4·89	7,800
Mar. 1	3,710	[illegible]	1·95	2,380	May 20	7,050	3·35	8·50	23,600
May 18	6,480	[illegible]	8·25	19,600	June 11	7,000	3·49	8·98	24,400
June 13	7,190	[illegible]	9·91	30,800	July 3	5,630	4·02	8·60	22,600
" 21	7,600	4·46	10·75	33,800	" 13	....	....	7·75	21,100
July 24	6,200	3·18	7·75	19,600	" 15	6,630	3·09	8·35	20,500
Sept. 5	5,180	2·25	5·73	11,600	" 26	6,680	3·42	8·46	22,870
1913					1916				
May 12	5,780	2·26	6·25	13,100	Feb. 12	6,440	0·43	2·60	2,800
June 10	8,390	4·50	12·27	38,100	July 22	7,366	4·03	10·70	29,700
July 7	1,850	4·10	10·75	32,400	Aug. 14	5,883	2·93	7·51	17,200
Oct. 22	4,400	1·5	4·37	6,630	Oct. 23	4,254	1·10	3·55	4,690
1914									
Mar. 31	3,610	0·77	2·58	2,790					

[1] All gauge heights in terms of new gauge installed March 24, 1916.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
May....	20,280	9,240	14,680	2·09	2·41
June....	36,520	20,280	30,410	4·34	3·84
July....	36,050	19,200	29,210	4·17	4·81
Aug....	....	....	....	....	....
Sept....	....	....	....	....	....
Oct....	....	....	....	....	....
Nov....	....	....	....	....	....
Dec....	....	....	....	....	....
Period...	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
May...	33,450	10,950	20,280	2·90	3·34
June...	34,800	29,300	32,330	4·62	5·15
July...	31,800	16,620	22,650	3·24	3·73
Aug....	16,500	12,210	13,650	1·95	2·25
Sept....	12,060	9,450	11,070	1·58	1·76
Oct....	9,300	7,900	8,577	1·22	1·41
Nov....	7,700	6,800	7,030	1·00	1·12
Dec....	6,800	6,500	6,761	0·97	1·12
Period..	34,800	6,500	15,290	2·18	19·88

* On maps recently published several changes have been made in the delineation of the upper tributaries of the South Thompson river ; an estimate of watershed area based on recent measurements gives nearer 6,750 sq. miles.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April[1]	9,970	2,800	[illegible],330	0·76	0·85
May	26,000	10,200	15,119	2·16	2·49
June	48,300	27,000	41,740	5·96	6·65
July	39,200	22,100	28,987	4·14	4·77
Aug.	21,200	13,000	15,319	2·19	2·52
Sept.	12,600	9,660	11,364	1·62	1·81
Oct.	9,360	6,970	7,660	1·00	1·26
Nov.	6,970	5,850	6,314	0·90	1·00
Dec.	6,060	4,140	5,170	0·74	0·85
Period	48,300	2,800	15,220	2·17	22·20
1915					
Jan.	4,200	2,960	3,525	0·50	0·58
Feb.	2,850	2,590	2,700	0·39	0·40
Mar.	2,850	2,510	2,570	0·37	0·42
April	11,200	2,850	6,518	0·93	1·04
May	26,800	12,000	20,029	2·86	3·30
June	26,300	21,300	23,770	3·40	3·79
July	23,100	20,900	22,450	3·20	3·69
Aug.	20,500	10,400	14,600	2·08	2·40
Sept.	10,000	5,830	7,445	1·06	1·18
Oct.	5,700	4,830	5,045	0·72	0·83
Nov.	5,300	4,610	5,020	0·72	0·80
Dec.	4,400	3,830	4,190	0·60	0·69
Year	26,800	2,510	9,822	1·40	19·12

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	3,570	3,390	3,400	0·50	0·58
Feb.[2]			3,000	0·43	0·45
Mar.[3]	2,940	2,720	2,783	0·40	0·46
April	9,000	2,720	4,920	0·70	0·81
May	24,430	9,160	17,783	2·54	2·93
June	30,430	24,225	28,107	4·02	4·48
July	29,950	16,800	25,175	3·60	4·15
Aug.	16,200	7,300	10,856	1·55	1·79
Sept.	7,300	5,400	6,223	0·90	1·00
Oct.	6,855	5,400	5,971	0·85	0·98
Nov.	8,220	7,000	7,677	1·10	1·23
Dec.	6,855	4,450	5,521	0·80	0·92
Year	30,430	2,720	10,125	1·45	19·78
1916					
Jan.	4,100	2,800	3,070	0·44	0·51
Feb.	2,800	2,800	2,800	0·40	0·43
Mar.	3,050	2,800	2,970	0·42	0·48
April	8,550	3,650	5,720	0·82	0·91
May	18,050	8,850	14,610	2·10	2·42
June	35,600	18,300	25,140	3·59	4·00
July	36,120	25,200	31,940	4·56	5·26
Aug.	24,700	11,600	17,050	2·44	2·81
Sept.	11,050	7,000	8,660	1·24	1·38
Oct.	7,600	4,350	5,380	0·77	0·89
Nov.	4,100	3,050	3,540	0·50	0·56
Dec.	3,050	2,600	2,800	0·40	0·46
Year	36,120	2,600	10,300	1·47	20·08

[1] April 1 to 11, estimated. [2] Estimated. [3] Partly estimated.

108—SPILLIMACHEEN RIVER—near mouth

Drainage area, 580 square miles

DESCRIPTION OF GAUGING STATION

Location—At highway bridge near mouth, about 4 miles from Spillimacheen.

Records available—June to Oct., 1912; June to Nov., 1913; April to Dec., 1914; April to Dec., 1915; April to Dec., 1916.

Gauge—Vertical staff ; read two or three times a week.

Channel—Is straight for 50 yards above and below section ; width at section, 105-135 ft. The control is a gravel bar, and there is a pronounced riffle at low water, 25 yards below section. Control is not permanent.

Discharge measurements—Are made from the downstream side of the highway bridge ; measuring section is good.

Winter flow—The river is generally affected by ice from November to April.

Accuracy—Results to June 22, 1916, should be within 10 or 15 per cent. A landslide occurred on June 22, which entirely altered rating. This was not fully determined in 1916. There is a possibility of backwater from the Columbia at high stages.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1912				
May 31	464	2·43	1·30	1,120
June 17	585	4·70	2·20	2,740
" 19	620	5·52	2·55	3,450
July 6	568	4·18	2·25	2,750
" 19	599	5·08	2·35	3,040
Sept. 29	381	1·45	0·42	554
1913				
May 20	466	2·60	1·17	1,210
June 25	608	7·39	2·75	4,420
July 11	570	6·60	2·60	3,880
" 27	613	6·60	2·57	4,070
" 30	571	4·70	2·10	2,710
Sept. 3	490	3·12	1·50	1,530
" 14	488	3·58	1·57	1,750
Nov. 26	330	1·14	0·25	378
1914				
June 17	670	8·88	3·3	5,920
July 31	585	5·84	2·45	3,430
Oct. 23	374	1·28	0·40	480
1915				
May 3	524	3·80	1·85	1,990
" 21	530	3·65	1·80	1,920
Oct. 22	425	1·19	0·40	507
1916				
June 5	6[illegible]3	6·24	2·75	3,960
" 13	565	3·97	2·04	2,240
July 5	620	6·76	3·00	4,190
Aug. 23	538	3·77	2·08	2,030
Nov. 10	329	0·69	0·20	228

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
June..	......	......	......	......	......
July....	......	......	......	......	......
Aug....	......	......	......	......	......
Sept.....	......	......	......	......	......
Oct....	......	......	......	......	......
1913					
April					
May[2]..	5,130	1,330	1,920	3·30	3·81
June..	8,000	3,080	5,180	8·92	9·95
July..	5,760	2,270	3,810	6·57	7·57
Aug..	4,520	1,450	2,920	5·04	5·81
Sept..	2,700	1,000	1,730	2·98	3·33
Oct..	1,100	505	822	1·42	1·64
Nov....	575	380	427	0·73	0·81
Dec.....	......	......	......	......	......
Period.	8,000	380	2,400	4·14	32·92
1915					
April....	1,640	348	785	1·35	1·51
May...	3,340	1,670	2,160	3·72	4·29
June....	3,870	1,810	2,480	4·28	4·77
July....	4,440	2,870	3,370	5·81	6·70
Aug....	4,440	2,440	3,350	5·78	6·66
Sept....	2,450	560	1,120	1·93	2·15
Oct.....	700	370	503	0·87	1·00
Nov.....	630	300	402	0·70	0·78
Dec.....	345	300	320	0·55	0·63
Period.	4,440	300	1,610	2·78	28·40
1912					
June...	5,190	835	2,850	4·92	5·48
July...	3,570	2,280	2,600	4·48	5·16
Aug....	3,370	1,050	2,350	4·05	4·65
Sept....	1,050	550	735	1·27	1·42
Oct.[1] ..	600	465	521	0·90	1·04
1914					
April...	905	200	468	0·81	0·90
May...	3,220	1,390	2,340	4·03	4·65
June..	5,900	2,100	3,830	6·61	7·38
July.	5,900	2,980	4,620	7·97	9·19
Aug....	3,480	1,700	2,460	4·24	4·89
Sept....	1,750	650	1,206	2·08	2·32
Oct....	1,000	425	635	1·09	1·28
Nov....	575	325	416	0·72	0·80
Dec....	375	......	270	0·47	0·54
Period.	5,900		1,804	3·12	31·95
1916					
April ..	700	300	389	0·67	0·75
May..	1,810	850	1,360	2·34	2·70
June .	10,100	1,810	4,460	7·70	8·59
July...	6,830	2,820	4,790	8·26	9·52
Aug....	3,870	1,750	2,680	4·62	5·33
Sept....	2,600	680	1,410	2·43	2·71
Oct....	1,140	391	550	0·95	1·10
Nov.[3] ..	......	......	298	0·51	0·57
Dec.[3] ..	......	......	230	0·40	0·46
Period.	10,100		1,800	3·10	31·73

[1] Freeze-up occurred Nov. 1, station abandoned for season. [2] First two weeks in May estimated. [3] Gauge height-discharge relation affected by ice and discharge estimated, Nov. 14 to 30, 280 sec.-ft., Dec. as shown.

109—SPIUS CREEK—2 miles from mouth

Drainage area, 300 square miles*

DESCRIPTION OF GAUGING STATION

Location—At ranch, 2 miles from mouth, in sec. 23, tp. 13, rge. 23, W. 6th mer.

Records available—Aug. 18 to Nov. 22, 1911; May 8 to Sept. 12, 1912; May 25 to Nov 30, 1913; Mar. 22 to Dec. 24, 1914; Mar. 7 to Oct. 15, 1915.

Gauge—Several gauges have been used. Staff gauges were first employed but were repeatedly washed out, so were replaced by a standard chain gauge; readings daily.

Channel—Is composed of rocks and boulders; velocity of water is high at all stages.

Discharge measurements—Well define rating curve.

Winter flow—Ice conditions usually exist from November to February.

Accuracy—Is considered high, except at freshet, when results should fall within 15 per cent. In 1915, no measurements were made under open water conditions.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Aug. 15	52	3·5	0·87[1]	130
Sept. 18	60	2·6	0·92[1]	156
1912				
June 22	193	2·5	2·90[2]	480
July 6	134	1·6	2·30[2]	217
" 24	36·5	2·6	1·75[2]	96
Aug. 14	28	2·0	1·50[2]	57
1913				
Aug. 1	85	1·6	6·0[3]	132
Aug. 21	44	2·1	5·8	94·6[4]
1914				
Mar. 18	111	1·73	1·48[5]	191
May 5	234	5·51	3·04	1,309
" 6	224	5·16	2·92	1,171
" 27	240	5·11	3·00	1,236
July 10	138	3·60	2·08	499
" 30	67·1	1·85	1·25	120
1915				
Feb. 12	27	1·00	1·70	28[6]

[1] Gauge No. 1. [2] Gauge No. 2. [3] Chain gauge. [4] Different section. [5] New chain gauge installed. [6] Ice conditions.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Sept					
Oct					
Nov					
1912					
May [2]	1,480	535	845	2.78	2.48
June..	700	250	430	1.43	1.60
July...	250	50	142	0.47	0.54
Aug	130	60	68	0.23	0.27
Sept	....	.....	.		.
Oct.	....			.	.
Nov					
1914					
April ..	1,370	180	840	2.80	3.12
May .	2,940	984	1,823	6.08	7.00
June....	2,677	514	1,217	4.06	4.53
July..	1,125	116	421	1.40	1.61
Aug.....	112	52	75	0.25	0.29
Sept....	310	52	118	0.39	0.43
Oct....	450	76	166	0.55	0.63
Nov....	769	238	459	1.53	1.71
Dec.[4]...	614	147	294	0.98	0.87
Period	2,940	52	595	1.98	20.26

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1911					
Sept	250	75	125	0.42	0.47
Oct	105	75	96	0.32	0.37
Nov [1]	105	75	83	0.28	0.23
1913					
May					
June	535	40	171	0.57	0.64
July [3]					
Aug.	265	43	131	0.44	0.51
Sept	564	123	200	0.67	0.75
Oct	304	123	192	0.64	0.74
Nov.	218	132	162	0.54	0.60
1915					
April	1,850	250	860	2.87	3.20
May.	2,130	580	948	3.16	3.64
June	600	200	418	1.39	1.55
July .	225	86	146	0.49	0.56
Aug .	160	61	87	0.29	0.33
Sept .	105	52	75	0.25	0.28
Oct. .	.....	.	. .	..	.....
Nov .	...	.	. .	..	. .
Dec .		...	......	......	....
Period	2,130	52	422	1.41	9.56

[1] For period Nov. 1 to 22. [2] May 8 to 31. [3] Pier to which gauge was fastened torn out. Chain gauge established Aug. 1, 1913, about 2 miles above dam. This gauge was unsatisfactory, so replaced by new chain gauge on March 18, 1914. [4] For period Dec. 1 to 24.

110—SPROAT RIVER—below lake

Drainage area, 128 square miles

DESCRIPTION OF GAUGING STATION

Location—800 feet below outlet from Sproat lake, 8 miles from Alberni.

Records available—Feb. 26, 1913, to Dec. 31, 1916.

Co-operation—Previous to June 1, 1914, by Provincial Water Rights Branch; since that date by B. C. Hydrometric Survey.

Gauge—12-foot wooden staff, nailed to crib on lake shore, 300 feet to right of outlet; read daily.

Channel—Slight curve at section, straight for 500 feet above and below, gravel and boulder bed, solid rock on left side; good control; rapids and falls below section.

Discharge measurements—Well define rating curve, except at extreme stages

Winter flow—Open all winter.

Accuracy—A, up to discharge of 2,500 sec.-ft.; B, between 2,500 and 6,000 sec.-ft.; C, above 6,000 sec.-ft. Monthly summary given below for 1913 embodies revisions based on later measurements. See NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
Feb. 22	483	2.42	4.43	1,170
Aug. 8	340	1.73	2.83	589
Oct. 6	386	1.83	3.37	707
" 13	485	2.38	4.45	1,152
Nov. 20	693	3.23	6.20	2,238
" 27	1,190	4.96	9.8	5,904
1914				
June 18	434	2.25	4.03	977
July 30	308	1.41	2.48	435
Sept. 10	212	0.75	1.43	160
Dec. 12	596	2.88	5.39	1,700
1915				
April 1	744	3.31	6.50	2,460
Sept 7	105	0.95	1.15	100
1916				
Mar 21	724	3.45	6.65	2,500
Nov. 1	400	1.69	3.39	676

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min	Mean	Per square mile	
1913					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	856	708	806	6·29	7·25
April	1,490	808	1,236	9·66	10·77
May	1,790	1,080	1,498	11·71	13·49
June	1,820	1,280	1,595	12·46	13·90
July	1,350	780	1,148	8·97	10·34
Aug.	785	330	530	4·14	4·76
Sept.	840	330	565	4·41	4·92
Oct.	1,260	675	940	7·34	8·44
Nov.	5,980	760	2,341	18·28	20·43
Dec.	5,110	1,890	3,112	24·31	28·01
Period	5,980	330	1,377	10·75	122·31
1915					
Jan.	2,520	880	1,550	12·10	13·95
Feb.	1,660	860	1,420	11·10	11·56
Mar.	3,050	1,140	1,930	15·07	17·37
April	4,120	1,220	2,490	19·45	21·70
May	1,250	940	1,080	8·44	9·73
June	920	470	680	5·31	5·92
July	450	250	348	2·72	3·14
Aug.	245	135	185	1·45	1·67
Sept.	135	85	108	0·84	0·94
Oct.	5,520	100	1,270	9·93	11·45
Nov.	5,280	1,650	2,390	18·70	20·90
Dec.	3,940	1,710	2,800	21·87	25·21
Year	5,520	85	1,354	10·58	143·54

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	5,900	1,750	3,470	27·10	31·20
Feb.	1,840	960	1,260	9·85	10·26
Mar.	3,370	1,750	2,360	18·40	21·20
April	4,560	1,720	2,950	23·02	25·68
May	2,100	1,200	1,540	12·05	13·89
June	1,200	830	985	7·69	8·58
July	820	440	625	4·88	5·63
Aug.	420	200	295	2·30	2·65
Sept.	680	160	355	2·77	3·09
Oct.	8,100	610	3,440	26·90	31·00
Nov.	5,600	2,140	4,120	32·20	35·90
Dec.	4,230	740	1,650	12·90	14·90
Year	8,100	160	1,920	15·00	203·98
1916					
Jan.	1,680	609	915	7·15	8·24
Feb.	3,000	603	1,820	14·20	15·30
Mar.	4,810	1,960	3,150	24·60	28·40
April	2,420	1,770	2,060	16·10	18·00
May	2,440	1,690	2,010	15·70	18·10
June	2,010	1,600	1,790	14·00	15·60
July	1,740	1,180	1,470	11·50	13·30
Aug.	1,140	522	774	6·05	6·98
Sept.	510	230	356	2·78	3·10
Oct.	570	138	208	1·63	1·88
Nov.	1,190	705	947	7·40	8·26
Dec.	1,420	714	1,060	8·28	9·55
Year	4,810	138	1,380	10·80	146·71

111—STAMP RIVER—near Stamp falls

Drainage area, 336 square miles

DESCRIPTION OF GAUGING STATION

Location—One-quarter mile above falls; 8 miles from Alberni, on Beaver Creek road, 3 miles above the confluence of Stamp and Sproat rivers.

Records available—March, 1913, to Dec., 1916.

Co-operation—Records to May 31, 1914, by Messrs Ritchie, Agnew Co., engineers, Victoria; subsequent records by B. C. Hydrometric Survey.

Gauge—14-foot wooden staff, on left bank, 80 feet below measuring section: read daily.

Channel—Straight for 600 feet above section and for 300 feet below; rock bed with gravel; good control.

Discharge measurements—Given below are by B. C. Hydrometric Survey. Measurements were also made by Messrs. Ritchie, Agnew Co. in 1913 and 1914.

Winter flow—Open all winter.

Accuracy—Results should be within 10 per cent.

General—Owing to circumstances arising out of the war it was not possible to obtain from Messrs. Ritchie, Agnew Co. their revised data for the period before the station was taken by the B. C. Hydrometric Survey. These engineers, however, made surveys and obtained considerable hydrographic data in this locality, which, no doubt, will become available later.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1914									
June 22	1,130	2·3	2·48	2,630	Sept. 11	750	0·7	0·60	500
July 31	944	1·2	1·40	1,130	1915				
					Sept. 8	810	0·47	0·31	384

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
June...	......	......	......	..	.
July....	......	......	......	......	......
Aug.....	......	......	......	......	......
Sept.....	......	......	......	......	......
Oct.....	......	......	......	......	......
Nov.....	......	......	......	......	......
Dec.....	......	......	......	......	......
Period...	......	......	......	......	......
1915					
Jan.	6,100	960	2,470	7·35	8·47
Feb...	3,800	1,130	2,140	6 37	6·63
Mar. ...	10,800	1,670	3,5[illegible]0	10·60	12·22
April...	10,400	2,200	4,270	12·70	14 17
May..	3,390	1,670	2,150	6·40	7·38
June...	1,800	960	1,400	4 17	4 65
July....	960	560	776	2 31	2 66
Aug.....	560	370	459	1 37	1·58
Sept.....	370	300	319	0·95	1·06
Oct.....	19,000	370	4,050	12 10	14 00
Nov.....	10,400	2,200	3,700	11·00	12·30
Dec....	9,520	1,930	4,960	14·80	17·10
Year....	19,000	300	2,521	7·51	102·22

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1914					
June...	3,190	2,200	2,630	7·83	8 73
July...	2,510	1,040	1,840	5·48	6·30
Aug....	1,040	560	830	2·47	2·85
Sept....	1,930	410	1,070	3 19	3·56
Oct....	15,100	1,340	5,980	17·80	20 52
Nov....	14,400	1,930	7,440	22·14	24·71
Dec....	5,530	880	2,110	6 28	7·25
Period.	15,100	410	3,129	9·32	73·92
1916					
Jan...	1,670	660	1,050	3 13	3 61
Feb. ..	7,160	560	2,300	6 85	7·39
Mar ..	10,400	1,930	3,780	11 30	13 00
April...	4,490	2,510	3,470	10 30	11 50
May..	6,430	2,680	3,760	11·20	12 90
June..	8,320	3,800	5,140	15 30	17 10
July...	4,490	2,340	3,380	10 00	11·50
Aug....	2,200	960	1,470	4·37	5·04
Sept....	1,040	410	650	1·94	2·16
Oct....	2,200	250	412	1·23	1 42
Nov....	2,680	960	1,630	4 85	5 41
Dec....	3,020	800	1,460	4·34	5·00
Year...	10,400	250	2,380	7·07	96 03

112—STAMP RIVER—at outlet of lake

Drainage area, 177 square miles

DESCRIPTION OF GAUGING STATION

Location—300 feet below outlet from Great Central lake, 16 miles from Alberni.

Records available—Feb. 20, 1913, to Dec. 31, 1916.

Co-operation—Results before June 1, 1914, by Provincial Water Rights Branch ; subsequent to that date by B. C. Hydrometric Survey.

Gauge—12-foot wooden staff, nailed to crib in lake, 300 feet to right of outlet ; read twice daily.

Channel—Straight for 300 feet above and 100 feet below ; rocky bed, some boulders ; at extreme high stage there is a discharge from slough 1,000 feet to right of stream.

Discharge measurements—Except at highest stages, rating curve well defined.

Winter flow—Open all winter

Accuracy—Good ; monthly summary given below for 1913 embodies revisions based on later measurements, see NOTE, page 309.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec*	*Feet*	*Sec.-feet*
1913									
Feb. 19	432	2·80	2·84	1,200	July 30	502	1·83	2·32	919
Aug. 14	431	2 03	2 40	877	Sept. 10	333	1·23	1·28	410
Oct. 15	576	2 54	3·37	1,465	Dec. 12	642	2·76	3·70	1,770
Nov. 7	494	2·10	2·71	1,034	1915				
" 21	702	3 18	4 43	2,230	April 17	827	3·36	5 00	2,780
" 26	831	3·82	5·52	3,170	Sept 7	310	0·93	0·92	248
Dec. 1	948	4·20	6·32	3,980	1916				
1914									
June 19	680	2·91	4·00	1,980	Oct. 31	464	1·81	2·10	841

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.	....	....	....	......	....
Feb.	....	....	....	......	....
Mar.	935	755	864	4·88	5·62
April	1,960	890	1,512	8·54	9·53
May	2,560	1,505	2,041	11·53	13·29
June	2,905	1,995	2,367	13·38	14·94
July	2,340	815	1,853	10·47	12·06
Aug.	1,400	540	919	5·19	5·98
Sept.	1,240	500	938	5·30	5·91
Oct.	1,585	805	1,160	6·56	7·56
Nov.	4,335	880	2,181	12·33	13·77
Dec.	4,030	1,780	2,912	16·45	18·97
Period	4,335	500	1,675	9·47	107·63
1915					
Jan.	1,830	770	1,280	7·23	8·33
Feb.	1,690	820	1,410	7·96	8·29
Mar.	3,370	1,180	2,140	12·09	13·93
April	4,500	1,650	2,960	16·72	18·65
May	2,030	1,470	1,670	9·43	10·87
June	1,490	830	1,170	6·61	7·37
July	820	485	677	3·82	4·40
Aug.	480	240	350	1·98	2·28
Sept.	265	180	220	1·24	1·38
Oct.	6,360	205	1,680	9·49	10·90
Nov.	5,820	1,660	2,370	14·50	16·20
Dec.	3,540	1,600	2,460	13·90	16·00
Year	6,360	180	1,549	8·75	118·60

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1914					
Jan.	4,850	1,820	3,208	18·12	20·90
Feb.	1,870	900	1,240	7·01	7·30
Mar.	2,760	1,900	2,436	13·75	15·85
April	4,820	2,030	3,316	18·72	20·90
May	2,540	2,050	2,317	13·08	15·08
June	2,070	1,700	1,848	10·44	11·65
July	1,750	880	1,368	7·73	8·91
Aug.	850	450	637	3·60	4·15
Sept.	1,310	340	707	4·00	4·46
Oct.	8,300	1,010	3,793	21·42	24·70
Nov.	5,370	2,570	4,113	23·24	25·95
Dec.	4,200	720	1,731	9·78	11·28
Year	8,300	340	2,230	42·60	171·13
1916					
Jan.	1,490	550	862	4·87	5·62
Feb.	2,240	570	1,300	7·34	7·92
Mar.	3,810	1,310	2,440	13·80	15·90
April	2,400	1,800	2,170	12·30	13·70
May	3,210	2,430	2,760	15·60	18·00
June	3,680	2,680	3,050	17·20	19·20
July	2,860	1,940	2,480	14·00	16·10
Aug.	1,910	830	1,270	7·18	8·28
Sept.	850	346	575	3·25	3·63
Oct.	330	160	250	1·41	1·63
Nov.	1,710	264	898	5·08	5·67
Dec.	1,300	615	915	5·17	5·96
Year	3,810	160	1,580	8·93	121·61

113—STAVE RIVER—at Stave Falls

Drainage area, about 450 square miles

DESCRIPTION OF GAUGING STATION

Location—Near Stave Falls in sec. 3, tp. 4, rge. 3, W. 7th mer.

Records available—May to Dec., 1901, and Mar., 1905, to Dec., 1915 (except April, 1905, and May to Sept., 1910).

Co-operation—Records are by the engineers of the Western Canada Power Co. Some check meterings have been made by the B. C. Hydrometric Survey.

Drainage area—Estimated, by the engineers of the company, at 450 sq. miles.

Gauge—The first gauge was above the dam and was flooded out in 1910. Since September, 1910, a vertical staff gauge below the dam has been used. This was fastened to a heavy timber crib loaded with rocks and referenced to bench marks. It was washed out in October, 1913.

Channel—Permanent rocky channel ; water swift at higher stages ; channel changed in October, 1913.

Discharge measurements—A large number of meter measurements were taken from permanent cable car station by engineers of Western Canada Power Co., and the rating curve is well defined. Check measurements by British Columbia Hydrometric Survey agree closely.

Winter flow—Open water all year.

Accuracy—Good. The maximum, minimum and mean monthly discharges as given below are revised estimates recently supplied by the company.

Control and Diversion—Since the beginning of 1912, stop logs in the main dam have held Stave lake at an artificial level ; hence, discharges since that date are not the natural flow of the river.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1901					
Jan.	......	......	....	......	......
Feb.	......	......	....	......	......
Mar.	......	......	....	......	......
April	......	......	....	......	......
May	18,360	2,648	6,695	14·88	17·16
June	10,410	4,310	5,933	13·19	14·73
July	4,585	3,531	4,130	9·18	10·58
Aug.	3,778	1,908	2,965	6·58	7·58
Sept.	2,330	1,200	1,654	3·68	4·10
Oct.	11,400	1,165	3,012	6·69	7·70
Nov.	20,830	4,450	9,515	21·14	23·60
Dec.	19,570	1,342	5,420	12·04	13·87
Period	20,830	1,165	4,915	10·92	99·32
1906					
Jan.	[illegible]	1,624	4,125	9·17	10·57
Feb.	[illegible]	[illegible]	3,645	8·10	8·42
Mar.	[illegible]	[illegible]	1,760	3·91	4·50
April	[illegible]	[illegible]	3,220	7·16	7·98
May	[illegible]	3,072	4,500	10·00	11·52
June	8,545	3,635	4,850	10·78	12·05
July	[illegible]	[illegible]	3,635	8·08	9·31
Aug.	[illegible]	1,343	2,067	4·60	5·29
Sept.	31,340	1,624	7,950	17·67	19·73
Oct.	20,510	2,650	8,400	18·67	21·53
Nov.	16,700	1,765	6,830	15·18	16·96
Dec.	6,355	1,413	3,018	6·71	7·72
Year	31,340	783	4,500	10·00	35·58
1908					
Jan.	5,510	1,342	2,980	6·62	7·62
Feb.	3,638	1,024	1,485	3·30	3·55
Mar.	6,180	1,165	3,458	7·68	8·86
April	7,275	1,694	3,402	7·56	8·44
May	5,510	3,072	4,420	9·81	11·31
June	9,460	4,450	6,172	13·72	15·31
July	8,548	3,531	6,705	14·90	17·18
Aug.	3,425	2,082	1,602	3·56	4·08
Sept.	4,025	848	2,084	4·63	5·15
Oct.	17,230	918	3,263	7·25	8·35
Nov.	32,200	1,835	14,790	32·87	36·66
Dec.	5,330	1,553	2,813	6·25	7·20
Year	32,200	848	4,431	9·85	133·71
1910					
Jan.	14,850	600	3,381	7·52	8·65
Feb.	5,330	847	1,868	4·15	4·31
Mar.	6,355	2,330	4,070	9·05	10·44
April	7,275	2,083	3,555	7·90	8·81
May	......	......	....	......	......
June	......	......	....	......	......
July	......	......	....	......	......
Aug.	......	......	....	......	......
Sept.	......	......	....	......	......
Oct.	20,750	1,976	7,220	16·04	18·50
Nov.	13,900	2,612	6,680	14·83	16·55
Dec.	6,710	2,294	3,946	8·77	10·10
Period	20,750	600	4,389	9·76	77·36
1912					
Jan.	10,450	882	3,618	8·04	9·25
Feb.	7,025	1,730	4,090	9·07	9·78
Mar.	1,730	469	770	1·71	1·97
April	2,153	706	1,665	3·70	4·12
May	5,297	2,436	3,898	8·66	9·97
June	10,840	3,107	5,490	12·20	13·61
July	4,096	2,613	3,025	6·72	7·73
Aug.	5,578	2,012	2,990	6·65	7·65
Sept.	7,028	1,059	3,290	7·31	8·15
Oct.	5,895	1,300	3,102	6·90	7·95
Nov.	15,000	1,906	6,652	14·79	16·51
Dec.	3,988	494	1,942	4·32	4·97
Year	15,000	459	3,377	7·50	101·66

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1905					
Jan.	......	......	....	......	......
Feb.	......	......	....	......	......
Mar.	24,000	3,070	5,630	12·52	14·43
April	......	......	....	......	......
May	4,730	2,153	3,421	7·60	8·76
June	6,000	3,780	4,605	10·23	11·42
July	3,425	2,648	2,975	6·61	7·61
Aug.	3,071	1,200	2,058	4·57	5·26
Sept.	18,000	1,271	6,585	14·63	16·33
Oct.	10,665	1,200	4,615	10·25	11·81
Nov.	6,177	1,271	2,380	5·29	5·89
Dec.	3,780	1,342	2,693	5·98	6·88
Period	24,000	1,200	3,	8·63	88·39
1907					
Jan.	2,083	[illegible]36	1,386	3·08	3·55
Feb.	6,885	1,270	3,692	8·20	8·53
Mar.	3,780	1,004	1,634	3·63	4·18
April	17,800	2,223	5,320	11·82	13·20
May	7,700	2,648	5,722	12·72	14·65
June	8,120	3,638	5,215	11·58	12·93
July	6,355	2,541	3,918	8·71	10·04
Aug.	4,170	2,013	2,713	6·03	6·93
Sept.	3,531	1,411	2,030	4·52	5·03
Oct.	1,705	706	1,247	2·77	3·19
Nov.	16,180	2,154	6,485	14·43	16·11
Dec.	13,520	2,082	5,450	12·11	13·95
Year	17,800	636	3,734	8·30	112·29
1909					
Jan.	7,275	1,024	2,858	6·35	7·31
Feb.	5,018	1,765	3,080	6·84	7·11
Mar.	3,530	1,341	1,964	4·37	5·02
April	3,920	1,695	2,327	5·17	5·76
May	9,715	2,438	4,151	9·23	10·63
June	11,400	5,225	7,650	17·00	18·99
July	8,120	3,920	5,400	12·00	13·83
Aug.	7,910	2,153	3,451	7·67	8·84
Sept.	5,507	1,765	2,825	6·28	7·00
Oct.	6,880	2,437	4,118	9·15	10·55
Nov.	37,000	1,765	9,110	20·23	22·57
Dec.	27,900	1,024	4,905	[illegible]	12·56
Year	37,000	1,024	4,320	9·60	130·17
1911					
Jan.	3,108	1,378	2,183	4·85	5·58
Feb.	1,306	776	1,095	2·43	2·53
Mar.	3,885	706	2,085	4·64	5·34
April	3,673	1,730	2,448	5·44	6·05
May	11,605	3,495	5,557	12·34	14·22
June	8,970	3,885	6,222	13·82	15·43
July	7,025	3,885	5,315	11·80	13·60
Aug.	3,672	2,153	2,602	5·78	6·65
Sept.	9,710	2,012	3,707	8·24	9·20
Oct.	5,050	1,164	2,148	4·77	5·49
Nov.	12,495	988	4,118	9·15	10·21
Dec.	5,863	2,152	3,338	7·42	8·54
Year	12,495	706	3,402	7·56	102·84
1913					
Jan.	3,706	706	1,573	3·50	4·03
Feb.	15,740	635	3,100	6·89	7·17
Mar.	3,777	953	2,450	5·45	6·27
April	5,436	2,012	3,885	8·64	9·64
May	8,580	2,577	5,470	12·14	13·99
June	9,036	6,565	7,332	16·30	18·20
July	9,248	4,165	6,801	15·11	17·42
Aug.	6,777	1,412	3,227	7·17	8·26
Sept.	22,270	1,588	5,265	11·69	13·05
Oct.	38,830	1,906	5,740	12·73	14·70
Nov.	24,710	2,013	9,093	20·20	22·54
Dec.	11,507	847	2,899	6·44	7·42
Year	38,830	635	4,736	10·52	142·69

114—SUMALLO RIVER—near mouth

Drainage area, 70 square miles

DESCRIPTION OF GAUGING STATION

Location—1 mile from mouth, and just south of the Railway Belt boundary.

Records available—July 12, 1914, to Nov. 22, 1916.

Co-operation—4 meter measurements were made during 1913 and 1914 by L. N. Jessen for McKenzie & Mann.

Gauge—Vertical staff on bridge near mouth ; read daily.

Channel—Straight for 200 feet above and below section ; boulders in stream bed ; good control.

Discharge measurements—Are made at road bridge ; rating curve well defined.

Winter flow—Stream open all winter, but during very cold weather anchor ice affects to some extent the relation between gauge height and discharge.

Accuracy—A up to 400 sec.-ft. ; B from 400 to 800 sec.-ft. ; D above 800 sec.-ft.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1913				
Sept. 19	76	2·30	1·00	175
Nov. 11	76	2·30	1·00	175
1914				
June 11	130	3·86	2·40	502
July 12	108	3·29	2·00	355
" 15	100	2·99	1·72	299
" 18	90	3·10	1·50	279
Dec. 16	57	1·33	0·74	76[1]
1915				
Mar. 11	41	1·30	0·22	54
Mar. 16	62	1·90	0·77	118
" 29	67	2·10	1·00	143
May 28	99	3·14	1·80	311
" 31	88	2·80	1·52	247
Oct. 29	146	4·05	2·68	591
1916				
April 1	88	2·74	1·49	241
July 9	163	5·53	3·05	903
" 11	159	4·72	2·95	752
Aug. 16	85	2·53	1·38	216

[1] Probably affected by ice.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	....	....	....	....	....
Nov.	....	....	....	....	....
Dec.	....	....	....	....	....
Period	....	....	....	....	....
1915					
Jan.	70	40	58	0·83	0·96
Feb.	45	40	44	0·63	0·66
Mar.	205	45	100	1·43	1·65
April	485	245	320	4·57	5·10
May	360	225	284	4·06	4·68
June	310	150	210	3·00	3·35
July	165	120	138	1·97	2·27
Aug.	120	80	89	1·27	1·46
Sept.	70	45	56	0·80	0·89
Oct.	485	45	157	2·24	2·58
Nov.	420	92	183	2·61	2·91
Dec.	150	92	112	1·60	1·84
Year	485	40	146	2·09	28·35
1914					
Aug.	135	90	112	1·60	1·85
Sept.	105	70	88	1·26	1·41
Oct.	105	70	85	1·21	1·39
Nov.	310	135	251	3·59	4·01
Dec.	245	70	111	1·59	1·83
Period	310	70	129	1·84	10·49
1916					
Jan.	106	53	72	1·03	1·19
Feb.	388	53	168	2·40	2·59
Mar.	880	150	300	4·28	4·93
April	525	233	335	4·79	5·34
May	1,420	360	695	9·93	11·40
June	2,950	620	1,420	20·30	22·70
July	1,240	310	656	9·37	10·80
Aug.	310	150	217	3·10	3·57
Sept.	150	82	103	1·47	1·64
Oct.	82	53	62	0·89	1·03
Nov.[1]	....	....	98	1·40	1·56
Dec.	....	....	70	1·00	1·15
Year	2,950	53	350	5·00	67·90

[1] No gauge reader available after Nov. 22. Discharge estimated Nov. 23 to 30, 80 sec.-ft.; Dec. as shown.

115—SUMALLO RIVER—8 miles from mouth

Drainage area, 17 square miles

DESCRIPTION OF GAUGING STATION

Location—8 miles from mouth, in sec. 28, tp. 3, rge. 24, W. 6th mer.

Records available—Irregular records beginning in July, 1914, to Nov., 1916.

Gauge—Vertical staff ; read at irregular intervals. In 1914 insufficient readings were taken to permit the mean monthly discharge to be estimated.

Chan: el—Straight for 100 feet above and below section. Fine gravel bed.

Discharge measurements—Well define rating curve except at high stages.

Winter flow—Station is somewhat affected by ice during very cold weather.

Accuracy—D. Poor, owing to infrequency of gauge readings.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					May 29	75	2·53	1·90	190
July 16	73	2·4	1·80	107 [1]	June 1	69	2·31	1·72	157
Dec. 16	15	2·9	1·00	44 [2]	Oct. 29	90	2·96	2·35	266
1915					1916				
Mar. 15	43	1·30	1·05	59	April 2	67	2·18	1·80	146
" 30	50	1·64	1·25	82	Aug. 16	74	2·01	1·76	149

[1] Station established. [2] Probably affected by ice.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1915						1916				
Jan.	38	16	22	1·30	1·50	Jan.	......	......	......	......	......
Feb.	27	7	17	1·00	1·04	Feb.	......	......	......	......	......
Mar.	100	16	37	2·18	2·51	Mar.	......	......	......	......	......
April	246	120	174	10·22	11·40	April	......	......	......	......	......
May	200	135	163	9·59	11·06	May	......	......	......	......	......
June	174	105	133	7·82	8·72	June	......	......	......	......	......
July	120	90	100	5·87	6·77	July	......	......	398	23·40	27·00
Aug.	85	40	63	3·69	4·25	Aug.	......	......	162	9·53	11·00
Sept.	50	16	28	1·62	1·81	Sept.	......	......	72	4·23	4·72
Oct.	336	16	85	5·02	5·79	Oct.	......	......	29	1·71	1·97
Nov.	254	62	116	6·83	7·62	Nov.	......	......	......	......	......
Dec.	105	62	75	4·40	5·07	Dec.	......	......	......	......	......
Year	336	7	84	4·94	67·54	Period	......	......	......	......	......

Note.—From July to Dec., 1914, gauge heights were recorded on 18 days only. In 1915 gauge readings were more frequent, but still irregular; discharges estimated by interpolation. In 1916 insufficient gauge readings to estimate monthly discharges Jan. to June; no gauge reader available after Nov. 15.

116—TEXAS CREEK—near mou Drainage area, 80 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge near mouth, 14 miles from Lillooet and on the west side of the Fraser river.

Records available—April 14 to Oct. 14, 1914; April 11 to Sept. 30, 1915.

Gauge—Vertical staff gauge nailed to bridge pier; read three times a week.

Channel—Shallow and covered with boulders.

Discharge measurements—The measuring section on the lower side of the bridge is rather poor, but is the best obtainable.

Winter flow—Measurements made only during the irrigation season.

Accuracy—C. Infrequency of gauge readings impairs accuracy.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					1915				
April 14	29·7	3·60	1·20	107 [1]	May 11	24·4	11·50	1·80	280
June 7	42·7	5·47	2·00	233	June 25	50·0	6·00	1·90	300
July 29	43·0	2·96	1·50	137	Aug. 10	34·4	3·17	1·30	109
Sept. 16	26·3	2·39	1·00	63	Dec. 5	20·7	1·23	0·61	25·4

[1] Station established.

* Revised value based on recent measurements.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1914				
May....	340	120	247	3·09	3·55
June....	560	210	337	4·21	4·69
July....	280	140	211	2·64	3·04
Aug.....	130	70	100	1·25	1·44
Sept.....	100	50	71	0 89	0·99
Period..	560	50	193	2·41	13·71

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1915				
May...	500	153	352	4·40	5·06
June...	545	294	370	4·62	5·15
July...	410	180	281	3·51	4·04
Aug....	180	77	130	1·63	1·88
Sept....	70	43	52	0·65	0·72
Period..	545	43	237	2·96	16·85

117—THOMPSON RIVER—at Spence Bridge

Drainage area, 21,000 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge, sec. 10, tp. 17, rge. 25, W. 6th mer.

Records available—Oct. 25, 1911, to Dec. 31, 1916.

Gauge—Standard chain gauge on traffic bridge ; read daily.

Channel—Width at measuring section, from 320 to 500 feet.

Discharge measurements—Are made from bridge; owing to great velocity at high water, meterings are difficult to obtain. However, rating curve is well defined.

Winter flow—River usually remains open, but, owing to exceptional weather, was frozen during February, 1916.

Accuracy—Results are considered to be accurate and should fall within 5 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911				
Oct. 25	2,780	3·7	4·0	10,300
Nov. 25	2,435	3·4	2·8	8,180
1912				
Feb. 17	2,200	2·7	1·4	5,900
Mar. 30	1,960	2·4	1·2	4,770
May 1	3,800	5·5	6·55	20,700
" 25	8,080	10·5	15·9	84,900
July 25	6,135	11·7	11·7	50,200
1913				
May 8	4,331	5·4	7·1	23,600
June 6	8,989	10·7	17·7	95,700

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*
June 18	9,229	10·8	18·15	100,000
Aug. 12	5,735	7·4	11·4	42,700
1915				
Feb. 13	2,058	2·5	1·7	5,150
1916				
July 10	8,550	9·80	16·5	84,200
" 31	7,360	9·10	14·1	66,800
Nov. 14	2,660	3·40	2·8	9,080
1917				
Jan. 12	2,000	2·65	1·2	5,320
Mar. 21	1,800	2·45	0·7	4,420

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1911				
Jan....	.....	.....	.....	.....	.....
Feb....	.....	.....	.....	.....	.....
Mar....	.....	.....	.....	.....	.....
April....	.....	.....	.....	.....	.....
May....	.....	.....	.....	.....	.....
June....	.....	.....	.....	.....	.....
July....	.....	.....	.....	.....	.....
Aug....	.....	.....	.....	.....	.....
Sept....	.....	.....	.....	.....	.....
Oct....	.....	.....	.....	.....	.....
Nov.[1]...	9,200	6,550	7,491	0·35	0·40
Dec...	7,750	4,910	6,553	0·31	0·36
Period...	.		.	.	.

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
	1912				
Jan....	8,800	4,910	6,668	0·32	0·37
Feb....	5,570	4,500	5,169	0·25	0·27
Mar....	5,290	4,910	5,085	0·24	0·28
April...	20,000	5,290	10,338	0·49	0·55
May...	92,100	20,600	57,042	2·72	3·12
June...	91,200	62,400	79,087	3·76	4·20
July...	80,400	43,900	55,735	2·65	3·05
Aug....	43,900	33,000	40,606	1·93	2·23
Sept....	30,100	18,800	25,453	1·21	1·35
Oct....	20,700	11,200	15,023	0·71	0·82
Nov....	11,200	8,600	9,681	0·46	0·51
Dec....	8,800	7,130	8,087	0·38	0·44
Year	92,100	4,600	26,498	1·26	17·19

* Measurements which take account of revisions made on recent maps indicate an area of about 21,325 sq. miles.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1913						1914					
Jan.	6,620	5,075	5,730	0·27	0·31	Jan.	7,000	5,330	6,208	0·30	0·34
Feb.	5,870	5,000	5,454	0·26	0·27	Feb.	5,870	5,375	5,625	0·27	0·28
Mar.	5,330	4,925	5,152	0·25	0·29	Mar.	5,870	5,530	5,742	0·27	0·31
April	23,200	5,240	11,749	0·56	0·62	April	25,500	5,640	14,593	0·70	0·78
May	73,600	23,200	42,460	2·02	2·33	May	71,910	26,880	54,304	2·59	2·99
June	110,420	78,000	95,976	4·57	5·10	June	89,000	61,170	73,908	3·52	3·92
July	86,800	52,070	64,703	3·08	3·56	July	78,880	45,460	64,210	3·06	3·52
Aug.	50,000	35,400	42,270	2·01	2·32	Aug.	43,600	25,040	33,133	1·58	1·82
Sept.	34,800	22,740	29,205	1·39	1·55	Sept.	24,580	15,240	19,210	0·91	1·02
Oct.	22,280	14,280	17,013	0·81	0·93	Oct.	24,580	15,660	18,820	0·90	1·04
Nov.	14,400	9,950	11,811	0·56	0·62	Nov.	21,820	13,650	17,152	0·82	0·91
Dec.	9,390	5,750	7,580	0·36	0·41	Dec.	13,650	7,490	9,675	0·46	0·53
Year	110,420	4,925	28,259	1·35	18·31	Year	89,000	5,330	26,881	1·28	17·46
1915						1916					
Jan.	8,550	5,640	6,830	0·32	0·37	Jan.	7,000	5,800	6,300	0·30	0·35
Feb.	5,750	5,420	5,560	0·26	0·28	Feb.[2]	......	......	5,500	0·26	0·28
Mar.	6,800	5,330	5,710	0·27	0·31	Mar.	8,600	6,200	7,720	0·37	0·43
April	33,300	6,800	22,210	1·06	1·18	April	21,800	8,700	13,500	0·64	0·71
May	74,500	33,800	57,580	2·74	3·16	May	57,900	23,000	45,400	2·16	2·49
June	67,300	52,100	57,500	2·73	3·05	June	106,000	57,900	79,220	3·77	4·21
July	62,000	53,500	57,110	2·72	3·14	July	102,500	67,800	83,550	3·98	4·59
Aug.	53,500	33,800	43,580	2·08	2·40	Aug.	64,700	34,500	46,760	2·23	2·57
Sept.	33,800	14,500	21,900	1·04	1·16	Sept.	34,500	18,200	25,730	1·23	1·37
Oct.	16,500	9,950	12,520	0·60	0·69	Oct.	17,800	11,600	13,450	0·64	0·74
Nov.	17,300	8,970	12,430	0·59	0·66	Nov.	11,300	7,000	8,360	0·40	0·45
Dec.	8,830	6,290	7,830	0·37	0·43	Dec.	7,000	4,150	5,550	0·27	0·31
Year	74,500	5,330	25,897	1·23	16·83	Year	106,000	....	28,400	1·35	18·50

[1] Nov. 1 to 5 estimated. [2] Gauge height-discharge relation affected by ice during Feb. Mean monthly discharge estimated from study of discharge at Spence Bridge before and after freeze-up and on a comparison of certain discharges on the North and South Thompson rivers.

118—THOMPSON RIVER—at Kamloops

Drainage area, 14,500 square miles*

DESCRIPTION OF GAUGING STATION

Location—At lower traffic bridge, ¾ mile below confluence of North Thompson and South Thompson rivers.

Records available—Gauge readings were taken at this station from April, 1911, to Dec., 1916. Several discharge measurements were made during this period, but, as it was not found possible to establish a satisfactory relationship between gauge height and discharge, the station was discontinued in 1915. The daily and monthly discharges for this station, as published in *Water Resources Papers*, Nos. 1, 8 and 14, are now not considered reliable.

Gauge—Standard staff gauge on bridge; read daily.

Channel—Width at station varies from 750 to 850 feet, while at high water, depth is from 12 to 17 feet greater than at low stages.

Discharge measurements—Are made from the bridge.

Winter flow—River generally freezes over about January 1, and remains so until early in March.

General—The flow of the Thompson river at Kamloops may be estimated approximately from the flow at the measuring station on the North Thompson and South Thompson and the total flow as measured at Spence Bridge, near mouth.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
1911									
Sept. 8	11,600	1·90	4·37	22,000	April 6	8,037	0·51	0·20	4,000
Oct. 3	10,100	1·36	2·50	13,700	July 9	14,300	3·33	8·50	47,700
Dec. 1	8,650	0·83	0·50	7,180	" 22	13,100	2·74	7·07	35,900
1912					Aug. 23	12,300	2·70	6·20	33,400
					1913				
Mar. 5	8,030	0·50	... .	3,980[1]	June 6	17,540	4·95	13·1	86,890

[1] Ice cover.

* Revised value based on recent measurements.

119—TOBY CREEK—near mouth

Drainage area, 250 square miles*

DESCRIPTION OF GAUGING STATION

Location—1 mile from mouth, on highway bridge on road from Athalmer to Wilmer; 1½ miles from Athalmer.

Records available—June to Sept., 1912; May 18 to Oct. 31, 1913; April 16 to Nov. 14, 1914; April 7 to Nov. 11, 1915.

Gauge—Vertical staff gauge; read daily.

Channel—Is straight above the section, but widens out below; two channels are formed by a central pier in the bridge; the flow is not at right angles to the bridge, and is swift.

Discharge measurements—Are made from highway bridge.

Winter flow—Toby creek remains frozen about four months, and frazil ice is prevalent.

Accuracy—Probably within 20 per cent. There is a possibility of backwater from the Columbia which impairs accuracy.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912				
May 28	359	2·22	2·00	797
June 29	397	2·80	2·48	1,110
" 14	423	3·[illegible]	2·60	1,270
July 23	378	3·03	2·25	1,140
Sept. 28	122	2·27	0·46	270 [1]
1913				
May 17	202	2·10	1·70	424 [2]
June 2	616	4·30	3·74	2,650
" 20	578	4·20	3·78	2,420 [1]
July 11	440	3·50	3·20	1,560
" 25	418	4·42	3·22	1,850
" 30	324	3·36	2·60	1,090
Sept. 3	246	2·46	2·20	644
" 13	231	2·93	2·20	676 [1]
Nov. 27	....	....	1·63	160 [3]
1914				
May 5	316	2·00	1·20	631
June 19	627	4·79	3·15	3,000
Oct. 22	159	1·87	0·6	298
1915				
Feb. 26	55·2	1·25	Ice	69 [3]
May 1	217	2·57	1·28	558 [2]
" 23	285	2·87	1·35	817
July 8	326	3·86	2·00	1,260
Sept. 24	153	2·24	0·60	342
Oct. 23	132	1·89	0·45	250
1916 [4]				
June 10	....	....	1·98	1,010
July 6	....	....	2·75	1,430

[1] Different section. [2] New gauge. [3] Ice conditions.
[4] From "Miscellaneous Meter Measurements," *W. R. Paper No. 81*, p. 352.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1912					
May....	.....	....	....	....	....
June....	3,750	530	1,660	6·64	7·41
July....	2,460	722	1,170	4·68	5·38
Aug....	1,190	370	709	2·84	3·27
Sept. [1]...	425	270	358	1·43	1·60
Oct..	....	....	....	....	....
1913					
May [2].	2,290	295	726	2·90	3·34
June...	3,650	1,200	2,130	8·52	9·51
July...	2,470	690	1,490	5·96	6·86
Aug....	1,960	690	1,230	4·92	5·66
Sept....	1,530	445	713	2·85	3·18
Oct....	555	395	441	1·76	2·03
1914					
May...	1,870	440	1,120	4·48	5·16
June ...	3,360	1,130	1,960	7·84	8·74
July....	3,360	1,370	2,340	9·36	10·78
Aug.....	2,130	725	1,210	4·84	5·57
Sept.....	915	350	479	1·92	2·14
Oct.....	350	305	336	1·34	1·54
Nov. [3]	350	.....	276	1·10	1·23
1915					
May...	990	494	659	2·64	3·04
June...	1,830	784	1,080	4·32	4·82
July...	2,290	945	1,610	6·44	7·42
Aug....	2,880	1,090	1,980	7·92	9·12
Sept....	1,090	278	468	1·87	2·09
Oct....	323	244	269	1·08	1·2[illegible]
Nov. [4]..	....	.....	.....	....	.....

[1] Partly estimated, creek froze up at the end of October, 1912. [2] First 17 days estimated. [3] Partly estimated; creek frozen Nov. 15, 1914. [4] Ice conditions after Nov. 12, 1915.

120—TRANQUILLE RIVER—near mouth

Drainage area, 230 square miles

DESCRIPTION OF GAUGING STATION

Location—About 20 feet above Cooney's diversion dam. Sec. 36, tp. 30, rge. 19, W. 6th mer.

Records available—July 4 to Oct. 21, 1911; Mar. 29 to Sept. 7, 1912; May 1 to Oct 31, 1913; May 3 to Nov. 14, 1914; April 1 to Sept. 30, 1915; April 1 to July 14, 1916. Station maintained only during irrigation season.

* Revised value based on recent measurements.

Gauge—Standard vertica staff gauge ; read daily.

Channel—Straight at the gauge section, about 20 feet wide. Bed, stones and boulders: control good.

Discharge measurements—Rating curve well defined.

W nter flow—Ice conditions prevail during winter months.

Accuracy—Good. In 1916 the flow of the creek at the station was diminished by a small diversion (max mum about 3 sec.-ft.).

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1911					Aug. 2	10·3	2 03	0·88	21
July 4	17·7	1·08	0·94	10·1 [1]	Sept. 10	19·2	1·70	1·01	33 [3]
Sept. 11	9·4	0·25	0·60	2·3 [1]	1913				
1912					May 5	29·0	4·00	1·43	115 [5]
Feb. 1	15·4	0·54	....	8·2 [2]	" 30	45·8	5·20	2·02	237
" 1	14·9	0·59	....	8·8 [2]	1914				
April 13	15·2	1·17	0·96	17·8 [3]	May 30	31·0	4·24	1·35	132
May 7	59·2	7·70	2·50	456 [4]	Aug. 4	14·5	0·59	0·65	8·6
" 12	74·5	7·73	2·70	576 [4]	1916				
" 25	52·0	6·04	2·10	314 [4]	Mar. 5	....	....	2·40	417
June 1	30·5	4·46	1·52	136 [4]	Sept. 15	13·6	0·39	0 55	5·3

[1] At Kamloops lake. [2] At Cooney's ranch (ice conditions). [3] At Cooney's ranch. [4] Foot bridge. [5] Above dam.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1911						1912					
April....	....	....	....	....	....	April...	245	4	51·9	0·23	0·26
May....	....	....	....	....	....	May...	720	180	420·0	1·82	2·10
June....	....	....	....	....	....	June...	155	18	39·1	0·17	0·19
July [1]...	33	4	13·6	0·06	0·06	July...	44	10	26·3	0·11	0·13
Aug....	12	1·5	3·5	0·02	0 02	Aug...	18	10	14·7	0·07	0·08
Sept.....	7	1·5	3·9	0·02	0·02	Sept...	....	....	....	....	....
Oct. [2]...	7	3·4	4·9	0 02	0 02	Oct. ..	....	....	....	....	....
1913						1914					
May....	614	117	288·8	1·26	1·45	May [4]..	577	84	314·0	1·36	1·47
June....	208	48	96·5	0·42	0 47	June...	95	38	66·0	0·29	0 32
July....	153	24	67·1	0·29	0·33	July...	34	10	16·0	0·07	0·08
Aug....	24	7·5	14·5	0·06	0 07	Aug...	10	4	6·3	0 03	0 03
Sept.....	10	4·1	5 8	0·02	0 02	Sept....	7	4	6·1	0 03	0 03
Oct. [3]...	14·9	4·1	10·4	0·04	0 05	Oct....	8	[illegible]	7·4	0 03	0 03
1915						1916					
April....	135	15	73	0·32	0·36	April...	165	8	42	0·18	0·20
May....	340	65	131	0·57	0·66	May...	460	135	230	1·00	1·15
June....	300	35	76	0·33	0·37	June...	265	36	127	0·55	0·61
July....	120	22	51	0·22	0·25	July...	....	....	....	....	....
Aug....	27	7	13	0·06	0 07	Aug...	....	....	....	....	....
Sept....	9	7	7	0·03	0 03	Sept..	....	....	....	....	....

[1] For period July 4 to 31. [2] Oct. 1 to 21. [3] Estimated last 6 days at 13·5 sec.-ft. [4] May 3 to 31.

121—TSOLUM RIVER—3 miles from mouth — Drainage area, 150 square miles

DESCRIPTION OF GAUGING STATION

Location—Upstream side of foot bridge, 2 miles from Sandwick.

Records available—May 31, 1914, to Dec. 31, 1916.

Co-operation—Records by Provincial Water Rights Branch and B. C. Hydrometric Survey.

Gauge—12-foot enamel staff, 20 feet downstream from bridge, right bank ; read twice daily. Gauge datum lowered 2·0 feet in 1915.

Channel—Straight for 500 feet above and 300 feet below section ; gravel bed ; stream confined by cribbing, both banks, in high water. Control changed about March 9, 1916.

Discharge measurements—Well define rating curve except at high stages.

Winter flow—Open all winter.

Accuracy—B and C. Change in control necessitated new rating curve ; for 1916, accuracy C.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1912					1915				
Jan. 8	86	1·05	2·05[1]	90·0[1]	April 21	131	1·40	5·83	181·0[5]
1913					Sept. 26	2·2	0·95	4·65	2·1[6]
Mar. 7	192	1·66	2·48[1]	3·2	Oct. 30	212	2·63	6·85	558·0
1914					1916				
May 31	127	1·35	3·78	171·0[2]	Mar. 16	198	2·90	6·74	576·0[7]
July 17	98	0·61	3·28	60·0	April 13	224	3·73	7·03	836·0[8]
Sept. 8	2	0·90	2·58	1·8[4]	Oct. 26	6·5	0·38	4·46	2·5
Nov. 10	291	3·03	5·30	882·0					

[1] Measurements in 1912 and 1913 by Provincial Water Rights Branch not to same datum as subsequent measurements. Gauge was washed out; new gauge in new situation. [2] 150 feet above footbridge. [3] New station established by B. C. Hydrometric Survey. [4] Low water section. [5] Gauge lowered 2·0 ft. [6] Not at regular section. [7] Temporary gauge out 3·39. [8] Good measurement.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area	Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
						1914					
June	......	......	......	......	......	June	320	95	230	1·53	1·71
July	......	......	......	......	......	July	195	18	63	0·42	0·48
Aug.	......	......	......	......	......	Aug.	28	4	11	0·07	0·08
Sept.	......	......	......	......	......	Sept.	2,100	3	310	2·06	2·30
Oct.	......	......	......	......	......	Oct.[1]	......	......	......	......	......
Nov.	......	......	......	......	......	Nov.	1,330	280	875	5·83	6·50
Dec.	......	......	......	......	......	Dec.	900	115	375	2·50	2·88
Period	......	......	......	......	......	Period	2,100	3	311	2·07	13·95
1915						1916					
Jan.	1,850	75	751	5·00	5·76	Jan.	215	3	53	0·35	0·40
Feb.	1,500	260	693	4·62	4·81	Feb.	740	2	219	1·46	1·58
Mar.	1,650	260	642	4·28	4·93	Mar.[2]	1,780	400	834	5·56	6·41
April	1,410	75	441	2·94	3·28	April	1,040	540	745	4·97	5·55
May	260	75	171	1·14	1·31	May	1,040	410	689	4·59	5·29
June	115	8	458	3·05	3·40	June	720	260	459	3·06	3·41
July	175	5	19	0·13	0·15	July	660	120	290	1·93	2·23
Aug.	8	3	4·2	0·03	0·04	Aug.	120	4	41	0·27	0·31
Sept.	18	5	6·4	0·04	0·04	Sept.	8	2	3	0·02	0·02
Oct.	1,800	8	444	2·96	3·41	Oct.	540	2	56	0·37	0·43
Nov.	980	28	467	3·11	3·47	Nov.	720	50	291	2·16	2·16
Dec.	1,650	450	990	6·60	7·61	Dec.	1,180	120	334	2·23	2·57
Year	1,850	3	424	2·83	38·21	Year	1,780	2	334	2·32	30·36

[1] No record for period Oct. 13 to 24. [2] Change in control about Mar. 9.

122—**TULAMEEN RIVER**—at Coalmont

Drainage ar 50 square miles

DESCRIPTION OF GAUGING STATION

Location—At Coalmont.

Records available—May 15 to Dec. 11, 1914 ; April 11 to Dec. 25, 1915 ; Feb. 17 to Dec. 31, 1916.

Drainage area—400 to 650 sq. miles.*

Gauge—Chain gauge on downstream side of bridge at measuring section ; standard staff gauge on right hand abutment for high water ; read daily.

Channel—Straight for about 700 feet at section ; bed, clean gravel. Change in control May 5, 1916.

Discharge measurements—Rating curves are fairly well defined.

Winter flow—Ice conditior revail during the latter part of December and during January and February.

Accuracy—Results considered fairly reliable, except for highest stages.

* Estimates differ : the smaller area is the estimate of the B. C. Hydrometric Survey and is used in preparing the monthly summaries below ; the higher value is based on measurements on recent maps.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1913					June 3	205	2.50	3.88	508
Nov. 16	228	3.76	....	846 [1]	1916				
1914					May 29	471	5.80	5.65	2,736
May 14	601	8.82	4.03	5,300	June 27	440	6.90	5.70	3,020
June 14	387	4.60	2.50	1,778	July 14	274	3.71	3.95	1,020
" 19	333	3.84	2.10	1,277	Aug. 2	177	2.38	3.05	422
July 26	130	1.05	0.13	137	" 31	74	1.30	2.00	95
Sept. 4	95	0.41	−0.30	39 [2]	Nov. 16	76	1.32	2.30	100 [4]
Nov. 25	181	1.73	0.63	314	1917				
1915					Jan. 11	67	1.13	1.90	76
April 9	257	3.21	4.33	825 [3]					

[1] Measurement made at Princeton before regular station was established. [2] Not at regular section. [3] New gauge, 2·88 feet lower. [4] Ice.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1914					
May...	......	......	......	......	......	May [1] ..	4,640	1,280	3,054	7.63	4.82
June...	......	......	......	......	......	June..	2,870	780	1,464	3.66	4.08
July...	......	......	......	......	......	July..	745	80	310	0.77	0.89
Aug.....	......	......	......	......	......	Aug.[2].	90	70	74	0.18	0.11
Sept.....	......	......	......	......	......	Sept.[3].	125	40	92	0.23	0.23
Oct.	......	......	......	......	....	Oct.[4]	180	60	112	0.28	0.32
1915						1916					
Mar.....	......	......	.....	......	......	Mar..	1,690	200	580	1.45	1.67
April....	......	......	......	......	......	April..	1,960	570	1,020	2.55	2.84
May ..	1,350	570	942	2.35	2.71	May..	5,170	1,740	2,880	7.20	8.30
June....	1,180	225	509	1.27	1.42	June..	7,850	1,900	3,480	8.70	9.71
July...	225	80	160	0.40	0.46	July..	2,020	480	1,130	2.82	3.25
Aug.....	120	60	80	0.20	0.23	Aug...	435	110	250	0.62	0.72
Sept.....	105	42	59	0.15	0.17	Sept...	170	30	93	0.23	0.26
Oct.....	1,930	50	329	0.82	0.94	Oct...	170	50	72	0.18	0.21
Nov.....	790	135	312	0.78	0.87	Nov...	1,020	65	175	0.44	0.49
Dec....	225	135	183	0.46	0.53	Dec....	220	75	96	0.24	0.28
Period...	1,930	42	322	0.80	7.33	Period.	7,850	30	980	2.44	27.73

[1] For period May 15 to 31. [2] Aug. 1 to 16. [3] Sept. 4 to 30. [4] Ice conditions obtained during parts of Nov. and Dec., 1914.

123—**WESTKETTLE RIVER**—near mouth

Drainage area, 690 square miles*

DESCRIPTION OF GAUGING STATION

Location—At footbridge near mouth, near Westbridge.

Records available—Feb. 23 to Sept. 30, 1914; Jan. 1 to Dec. 31, 1915; Feb. 27 to Dec. 31, 1916.

Gauge—Standard vertical staff gauge ; read daily. Gauge lowered 1 ft. on March 24, 1915.

Channel—Is straight for 500 feet above and below measuring section; bed, gravel and boulders.

Discharge measurements—Are made from bridge.

Winter flow—Partial ice conditions prevail during January and February.

Accuracy—Considered fairly high, results should fall within 10 per cent.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
	Sq. feet	Ft. per sec.	Feet	Sec.-feet		Sq. feet	Ft. per sec.	Feet	Sec.-feet
1914					1916				
June 7	304	4.05	1.78	1,235	Mar. 15	88	0.91	0.59	80
July 20	122	1.43	−0.09	174	June 21	285	3.52	2.59	1,003
Aug 27	35	1.20	−0.71	42 [1]	Aug. 7	133	1.55	1.08	207
1915					1917				
Mar. 24	135	1.21	1.00	164 [2]	Jan. 15	23	1.43	....	32 [3]
June 8	280	3.50	2.50	982					

[1] Low water section. [2] New gauge, datum 1 ft. lower. [3] Ice cover.

* Another estimate is about 660 sq. miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
Mar.	....	......	......	....	....
April	....	......	......	....	....
May	....	......	......	....	....
June	....	......	......	....	....
July	....	......	......	....	....
Aug.	....	......	......	....	....
Sept.	....	......	......	....	....
Period.	....	......	......	....	....
			1915		
Jan.	230	[illegible]	[illegible]	[illegible]	0·29
Feb.[1]	....	......			....
Mar.[1]	....	......			....
April	1,640	290	[illegible]	[illegible]	1·46
May	2,880	1,0[illegible]	[illegible]	[illegible]	3·09
June	2,020	400	[illegible]	[illegible]	1·38
July	975	340	[illegible]	[illegible]	0·93
Aug.	550	110	247	[illegible]	0·41
Sept.	120	80	94	[illegible]	0·15
Oct.	185	80	[illegible]	[illegible]	0·18
Nov.	275	80	[illegible]	[illegible]	0·24
Dec.	260	100	[illegible]	[illegible]	[illegible]
Period	2,880	80	[illegible]	0·74	[illegible]

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
			1914		
Mar.	445	150	280	0·41	0·47
April	2,610	360	1,690	2·41	2·69
May	4,115	1,910	2,778	4·03	4·63
June	3,615	775	1,649	2·39	2·67
July	705	158	349	0·51	0·59
Aug.	120	15	46	0·07	0·08
Sept.	145	30	91	0·13	0·15
Period.	4,115	15	979	1·42	11·28
			1916		
Jan.	......	......	......	....	....
Feb.	......		......	....	....
Mar.	125	52	95	0·14	0·16
April	1,430	150	540	0·78	0·87
May	2,550	950	1,510	2·19	2·52
June	2,020	900	1,360	1·97	2·20
July	2,070	270	[illegible]	1·09	1·26
Aug.	270	85	165	0·24	0·28
Sept.	98	52	73	0·11	0·12
Oct.	67	52	55	0·08	0·09
Nov.	67	50	53	0·08	0·09
Dec.	45	35	41	0·06	0·07
Period.	2,550	35	465	0·67	7·66

Note.—Gauge readings un[illegible]

[1] Ice conditions obtained during part of Feb. and Mar., 1915.

124—WIDGEON (SILVER PITT) CREEK—2 miles from mouth Drainage area, 30 sq. miles*

DESCRIPTION OF GAUGING STATION

Location—At lower end of cañon, about 2 miles from mouth, in sec. 8, tp. 4, rge. 5, W. 7th mer.
Records available—August 9, 1912, to Dec., 1915; discontinued 1916.
Gauge—Vertical staff gauge; read three times a week.
Channel—Rocky, uneven bottom, but permanent control; deep, still pool just above gauging section.
Discharge measurements—Are made by wading at section near gauge or by cable at high water.
Winter flow—Open water all year.
Accuracy—C. Infrequency of gauge readings impairs accuracy.

DISCHARGE MEASUREMENTS

Date	Area of section	Mean velocity	Gauge height	Discharge	Date	Area of section	Mean velocity	Gauge height	Discharge
1912	*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*		*Sq. feet*	*Ft. per sec.*	*Feet*	*Sec.-feet*
Aug. 9	104	2·39	1·50	242	Oct. 25	73	1·60	0·99	116
1913					1914				
May 25	121	3·05	2·15	369	July 20	60	1·50	0·90	90
July 16	100	1·83	1·41	190	Nov. 5	142	2·86	2·19	405
Sept. 16	68	1·35	0·87	92	1915				
" 17	66	1·27	0·90	84	July 19	45	1·28	0·62	57·6

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
			1912		
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	262	15	88	2·93	3·27
Oct.	362	35	135	4·50	5·18
Nov.	853	109	322	10·73	11·98
Dec.	285	90	142	4·73	5·44
Period	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
			1913		
Jan.[1]	125	84	94	3·13	3·60
Feb.[1]	251	51	111	3·70	3·84
Mar.[1]	175	90	113	3·77	4·33
April[1]	335	100	250	8·33	9·30
May	563	278	347	11·57	13·33
June	428	196	286	9·53	10·63
July	322	117	221	7·37	8·47
Aug.	461	45	164	5·47	6·28
Sept.	884	45	214	7·13	7·95
Oct.	1,023	45	242	8·07	9·29
Nov.	973	105	343	11·43	12·76
Dec.	428	100	223	7·43	8·55
Year	1,023	45	217	7·23	98·33

* Revised value based on recent measurements.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1914		
Jan.	1,220	150	450	15·00	17·30
Feb.	565	115	240	8·00	8·31
Mar.	580	145	335	11·17	12·86
April	530	240	310	10·33	11·53
May	630	250	320	10·66	12·27
June	580	220	335	11·17	12·47
July	210	57	125	4·17	4·79
Aug.	77	30	50	1·66	1·91
Sept.	660	30	300	10·00	11·16
Oct.	820	125	330	11·00	12·67
Nov.	910	125	485	16·17	18·03
Dec.	550	25	110	3·66	4·21
Year	1,220	25	280	9·33	127·54

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
			1915[1]		
Jan.	660	35	223	7·43	8·[illegible]
Feb.	460	95	191	6·37	6·62
Mar.	547	84	235	7·83	9·03
April	742	155	306	10·20	11·40
May	460	175	288	9·60	11·06
June	175	57	108	3·60	4·01
July	207	40	66	2·20	2·54
Aug.	110	25	33	1·10	1·27
Sept.	195	25	58	1·93	2·16
Oct.	1,160	35	433	14·43	16·63
Nov.	740	145	310	10·33	11·53
Dec.	1,160	70	436	14·53	16·74
Year	1,160	25	224	7·47	101·54

[1] Very few gauge heights recorded in early months of 1915; on Jan., 5; Feb., 5; Mar., 3; April, 3, discharges interpolated for days on which gauge heights were not recorded.

MISCELLANEOUS RECORDS

WATER LEVELS ON CERTAIN NAVIGABLE LAKES IN SOUTHERN BRITISH COLUMBIA

The Department of Public Works, Canada, the Canadian Pacific railway and other interested parties, have established gauges on some of the larger lakes in the southern portion of the province for use in connection with navigation and for other purposes.

Department of Public Works, Canada, Gauges The gauges of the Department of Public Works were all established in 1915. * Their zeros were set at what was assumed to be 'low water' on the respective lakes, and the elevations were determined with reference to the Canadian Pacific Railway bench marks. The elevations used by the department, as given below, were determined from data supplied by the company, supplemented by precise levels by the department. The Canadian Pacific datum is low tide at Burrard inlet. In determining these elevations, the department co-operated with the B. C. Hydrometric Survey.

LIST OF DEPARTMENT OF PUBLIC WORKS, CANADA, GAUGES
(Sometimes referred to as 'Government Gauges')

Lake	Situation of gauge	Elevation of gauge zero (1915)
		Feet
Upper Arrow lake	Arrowhead	1,376·19
do.	Nakusp	1,376·19
Narrows between Upper Arrow and Lower Arrow lakes	Burton	1,374·07
Lower Arrow lake	Renata	1,368·65
Columbia river	West Robson	1,367·50
Slocan lake	Slocan City	1,757·90
West Arm Kootenay lake	Nelson	1,743·42
do.	Proctor	1,744·44
Kootenay lake	Kootenay Landing	1,745·00
do.	Kaslo	1,745·00
do.	Lardo	1,745·00

NOTE—The above gauges are not read regularly. For such records as are available application may be made to the District Engineer's office of the Department of Public Works Canada, at Nelson, B. C.

* Except gauge at Nelson

Canadian Pacific Railway Gauges

Gauges have been established by the Canadian Pacific railway in connection with its British Columbia lake and river service. These gauges were installed in the spring of 1912, their zeros being placed at 'low water' on the respective lakes. The elevation of low water was "determined as accurately as it was possible to do by gaining information in regard to water levels for previous years." Recently the elevations of the zeros of these gauges have been determined by making a comparison with the D.P.W. gauges installed in the same vicinity. The elevations here given, therefore, are with respect to the D.P.W. datum, which is the C.P.Ry. datum of mean low tide at Burrard inlet.

LIST OF CANADIAN PACIFIC RAILWAY GAUGES

Lake	Situation of guage	Elevation of gauge zero
		Feet
Upper Arrow lake	Nakusp	1,376·00
Columbia river	West Robson, at end of dock	1,365·50
Slocan lake	Slocan City	1,758·15
West Arm, Kootenay lake	Nelson, lower end of C.P.Ry. wharf	1,744·02
do.	Proctor, on dolphin at transfer slip	....
Kootenay lake	Kootenay Landing, at end of dock	....
do.	Lardo, at wharf	1,744·50
Trout lake	Gerrard	....

The above gauges are read weekly from the commencement of the rising of the water in the various lakes until after the water commences to recede. The records given below have been supplied by the late Captain Gore, superintendent of the British Columbia lake and river service ; office at Nelson.

Some records of high and low water on Kootenay lake at Kootenay Landing are also available. These were taken by Captain William Seaman, of the *Kooskanook*, and are as follows :

HIGH AND LOW WATER ON KOOTENAY LAKE AT KOOTENAY LANDING
(Records by Capt. William Seaman, of steamer *Kooskanook*)

Year	High water		Low water		
	Date	As recorded	Date	As recorded	Reduced to datum of low water 1905
		' "			' "
1900	....	....	....	....	1 4
1901	June 6	18 10	Feb. 15	Low mark last year 1900	1 4
1902	June 4	19 1	Feb. 15	Low mark last year 1901	1 4
1903	June 19	24 10	Mar. 13	8 in. below low mark 1902	8
1904	June 22	14 0	Mar. 6	7 in. above low mark 1903	1 3
1905	June 14	15 0	Feb. 19	15 in. below low mark 1904	0
1906	July 13	11 6	Feb. 21	2 in. above low mark 1905	2
1907	June 9	16 8	Feb. 15	2 in. above low mark 1906	4
1908	June 17	19 6	Feb. 12	do.	4
1909	June 22	19 6	Feb. 19	do.	4
1910	May 29	15 6	Mar. 1	do.	4
1911	June 23	18 7½	Mar. 8	4 in. below low mark 1910	0

NOTE—The records by Capt. Seaman, taken at Kootenay Landing, confirm in a general way the records of Mr. Astley and of Mr. McCulloch taken at Nelson.

The West arm of Kootenay lake is not very wide and at places is comparatively shallow. From the various records available for Kootenay lake, there would appear to be, between the water surface in the main portion of the lake and at Nelson, a difference in level which varies from a few inches at low water to over two feet at high stages.

Respecting the gauge at Kootenay Landing, Captain Seaman has stated:

"This gauge was moved each year and amount recorded as follows, as the case may have been—3″ below low mark of last year, or 3″ above low of last year.

"For high water this gauge was continued in sections until high water was reached and left in place until the next high water—if not broken out or carried away by logs or such like, but usually O.K.

"The gauge was always placed at low water of each year."

WATER LEVELS ON CERTAIN NAVIGABLE LAKES IN BRITISH COLUMBIA

(Records taken by British Columbia Lake and River Service—office, Nelson, B.C.—of the Canadian Pacific Railway)

Date	Nakusp	West Robson	Slocan City	Nelson	Proctor	Kootenay Landing	Lardo	Gerrard
1912	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
Mar. 11	0	11	0	....	0	9	0	0
" 18	0	9	0	....	0	9	0	0
" 25	0	9	0	....	5	8	0	0
April 1	0	1 0	1	....	9	11	5	0
" 7	11	1 3	3	....	1 6	1 10	11	0
" 14	2 7	2 2	7	....	3 0	3 7	2 2	1 7
" 21	4 2	3 7	1 0	....	4 2	4 4	2 9	2 1
" 28	5 2	5 1	1 5	....	4 7	5 2	4 4	2 3
May 5	6 3	6 0	1 8	....	5 3	5 8	4 11	2 6
" 12	8 3	8 7	1 8	....	8 8	8 0	6 1	3 6
" 19	12 10	12 2	3 8	....	11 1	10 5	10 1	4 7
" 26	15 1	16 7	5 0	....	11 6	11 9	11 5	5 2
June 2*	13 2	15 11	5 0	....	11 4	11 7	11 8	4 6
1913								
Mar. 16	5	1 3	2	....	1 0	1 0	0	0
" 23	5	1 3	2	....	1 0	1 0	0	0
" 30	5	1 0	2	....	1 0	1 0	2	0
April 6	5	11	2	....	1 3	1 0	6	0
" 13	8	10	3	....	2 1	1 6	8	0
" 20	3 6	2 8	1 2	....	4 5	2 10	3 0	0
" 27	6 1	5 6	2 2	....	6 6	4 6	5 5	0
May 4	5 10	6 2	2 1	....	6 11	4 4	6 0	0
" 11	6 7	6 11	2 10	....	7 3	4 10	6 10	0
" 18	8 7	10 1	3 0	....	9 0	8 1	8 1	0
" 25	11 1	11 0	3 6	....	10 7	9 8	8 10	4 9
June 1	16 0	20 2	6 10	....	16 0	15 1	14 5	5 0
" 8	22 11	23 5	8 9	....	20 0	20 7	21 1	6 10
" 15†	21 9	30 2	8 3	....	21 6	22 6	22 5	8 4
1914								
Mar. 29	9	2 0	0 6	....	2 6	1 1	1 2	....
April 5	1 2	2 0	0 8	2 0	3 4	1 1	1 3	....
" 12	2 3	2 6	1 3	2 3	3 6	2 5	2 6	....
" 19	5 2	5 2	2 0	5 3	5 6	4 4	4 3	....
" 26	7 2	7 2	2 6	5 8	7 2	6 2	6 2	....
May 3	9 0	8 2	3 0	6 11	8 6	7 1	6 11	....
" 10	11 1	9 2	3 6	8 2	10 2	9 2	8 11	....
" 17	14 0	12 0	4 10	10 2	12 0	11 4	10 11	....
" 24	15 0	15 0	5 3	12 0	14 6	13 1	13 2	....
" 31	15 2	17 9	5 6	12 2	16 0	13 7	13 9	....
June 7	19 0	20 3	6 0	....	17 4	14 8	14 10	....
" 14	18 0	20 3	5 7	....	15 6	14 1	14 2	....
" 21	23 0	24 6	6 10	....	16 9	15 3	15 6	....
" 28‡	20 0	22 0	6 10	....	15 9	15 7	15 0	....

* Water begins to fall everywhere. No record kept of same.
† Water line thereafter shows recession from above records.
‡ Water receded after June 28.

WATER LEVELS ON CERTAIN NAVIGABLE LAKES IN BRITISH COLUMBIA—*Continued*

Date	Nakusp	West Robson	Slocan City	Nelson	Proctor	Kootenay Landing	Lardo	Gerrard
1915	' "	' "	' "	' "	' "	' "	' "	' "
Mar. 1	9	1 6	....	....	....	....	....	....
" 7	9	1 6	....	....	....	3	....	....
" 14	9	1 5	....	....	....	2	....	....
" 21	1 1	1 7	....	2	....	5½	....	....
" 31	1 10	2 3	....	8	....	10	....	....
April 7	4 0	3 5	....	1 7	....	1 10	....	....
" 14	5 1	5 0	1 8	2 5	....	2 11	....	....
" 21	8 1	7 2	2 4	4 4	5 1	5 2½	7 5	....
" 30	8 10	9 7	3 0	5 7	6 3	6 6	7 5	....
May 7	13 0	14 6	3 5	6 5	6 5	7 7	8 7	....
" 14	14 0	15 6	4 0	7 8	8 6	8 10½	10 0	....
" 21	18 6	15 4	4 0	7 11	8 6	9 1½	10 0	....
" 31	14 11	16 5	4 8	8 1	8 10	9 4	10 3	....
June 7	13 0	14 6	4 9	8 0	8 10	9 3½	10 2½	....
" 14	13 9	15 3	4	7 10	**	8 10	**	....
" 21	14 0	15 6	4 1	7 6	....	8 8	....	....
" 30	15 8	17 0	4 7	7 11	....	9 2	10 1	....
July 7	15 2	**	4 5	8 4	....	9 9	....	....
" 11	14 8	....	4 1	8 0	....	9 4	....	....

** Water began to fall.

Water Levels of Kootenay Lake at Nelson

In addition to the gauge heights above tabulated for various points on Kootenay lake, the following records have been secured for gauges at Nelson, on the West arm of Kootenay lake.

Records by A. L. McCulloch, C. E.

Between 1895 and 1912, certain records of water levels at Nelson were taken by Mr. A. L. McCulloch. It has been stated that the gauge was set with zero at the low water elevation of 1905. These records are given below. The elevation of the zero of this gauge in terms of D.P.W. datum (see above) is 1,743·42.

There are also certain miscellaneous records of high and low water at Nelson, which are as follows, the zero of the gauge being the same as for the other records taken by Mr. McCulloch :

HIGH AND LOW WATER ON KOOTENAY LAKE AT NELSON
(Records by A. L. McCulloch, C.E.)

Year	High water	Low water	Year	High water	Low water
	Feet	*Feet*		*Feet*	*Feet*
1894............	28·2	....	1905............	13·0	0·0
1898............	19·4	2·0	1906............	10·6	0·5
1899............	18·0	0·7	1907............	....	0·5
1900............	....	....	1908............	16·4	0·7
1901............	17·3	1·9	1909............	16·9	0·6
1902............	18·4	....	1910............	....	0·9
1903............	22·5	2·0	1911............	17·0	0·6
1904............	14·5	....	1912............	....	−0·1

WATER LEVELS OF KOOTENAY LAKE AT NELSON

(Records by A. L. McCulloch, C.E.)

Date	Gauge height	Date	Gauge height	Date	Gauge height	Date	Gauge height
	Feet		*Feet*		*Feet*		*Feet*
1905		1906		1906		1909	
Feb. 1	0·0	Feb. 27	0·9	Nov. 5	2·7	Feb. 8	1·0
Mar. 4	0·5	Mar. 14	0·5	" 15	3·0	" 23	0·8
" 9	0·9	" 26	0·5	Dec. 11	2·3	Mar. 7	0·7
" 18	1·2	April 2	0·9	1907		" 16	0·6
" 31	1·2	" 8	1·8	Jan. 1	1·5	" 25	0·8
April 24	2·2	" 15	3·0	" 20	0·6	April 12	1·5
" 29	3·7	" 18	3·5	Feb. 1	0·5	" 24	2·1
May 5	4·4	" 26	6·0	" 12	0·7	May 10	3·8
" 10	5·1	" 29	6·6	" 20	0·7	" 19	4·9
" 19	6·7	May 6	8·0	" 26	0·9	" 29	8·6
" 28	7·9	" 13	9·1	Mar. 5	1·3	" 31	9·7
June 1	8·5	" 27	9·7	" 13	1·2	June 1	10·3
" 6	10·8	June 16	10·0	" 20	1·0	Dec. 16	3·1
" 17	13·1	July 2	9·8	" 30	1·3	1910	
" 20	12·6	" 7	10·2	April 16	2·9	Jan. 8	1·5
" 23	12·2	" 17	10·2	May 1	4·5	Feb. 11	1·2
July 5	10·2	" 20	9·7	June 2	13·3	" 28	0·9
" 20	9·2	" 31	7·8	Aug. 18	8·2	Mar. 9	1·2
" 22	8·1	Aug. 2	7·5	Oct. 13	4·9	" 27	4·0
Aug. 10	7·0	" 9	6·4	1908		April 17	5·7
Sept. 2	4·3	" 16	5·8	Jan. 8	1·4	June	13·6
Nov. 5	2·8	" 22	5·3	Feb. 9	0·7	1911	
Dec. 1	1·6	Sept. 6	4·3	Mar. 17	0·9	Sept. 6	5·1
" 22	1·1	" 16	3·9	May	8·3	1912	
1906		" 25	3·3	Dec. 2	2·4	Jan. 16	0·2
Jan. 1	0·9	Oct. 8	2·8	" 23	1·4	Mar. 10	0·0
" 3	0·7	" 20	2·6	1909		" 24	−0·1
Feb. 18	0·6	" 26	2·6	Jan. 19	0·5	April 21	4·0

Records by B.C. Hydrometric Survey

Since 1913 continuous gauge readings have been taken at Nelson by the British Columbia Hydrometric Survey.* The gauge used by this survey and read daily is the same gauge as used by the Department of Public Works, Canada, and is a vertical staff, 20 feet long, situated at Astley's wharf. Its zero elevation, as given above in list of Department of Public Works gauges, is 1,743·42 feet, D.P.W. datum. When installing this gauge its zero was set at the same elevation as the gauge previously used by Mr. McCulloch.

Records by Mr. Astley

During the high-water periods of certain years records were taken by Mr. Astley. The gauge used was set on a pile at the rear or north side of the Nelson boat-house. On October 25, 1911, the zero of this gauge was tied in by D. C. Jennings to the C. P. Ry. datum at the crossing of Josephine street and found to be 24·11 feet below the base of rail ; the elevations being as follows :

	Elevation, feet
Base of rail, Josephine street crossing	1,779·50
Water level, Oct. 25, 1911	1,756·99
Zero of gauge on pile in rear of boat-house	1,755·39

* See *Water Resources Paper No. 14*, pp. 412-416.

A change in the zero elevation of this gauge was made between 1910 and 1911—the 1911 gauge being 1¾ inches higher. The explanation of the change appears to be as follows : The lower portion of the gauge of 1910, which was originally set with zero at 'low water', had been damaged. In 1911, a new gauge was established. Later in the year, it was discovered that the new gauge did not correspond with the upper portion of the old gauge, which still remained in its original position. The upper portion of the old gauge was, therefore, in 1911, raised 1¾ inches, corresponding to the difference found to exist, and, as thus raised, constituted a part of the new gauge as employed for the 1911 readings.

Records taken by Mr. Astley were published in the *Nelson News*. Those for 1908 to 1911 are given below. Possibly further search in earlier files of this newspaper might reveal other records.

WATER LEVELS OF KOOTENAY LAKE AT NELSON, 1908 TO 1911

(Records by Mr. Astley, copied from the *Nelson News*)

Date	Gauge height	Date	Gauge height	Date	Gauge height	Date	Gauge height
1908	′ ″		′ ″		′ ″		′ ″
June 11	14 11	June 17	16 3	May 25	13 7	April 21	2 6¾
" 12	15 5¾	" 18	16 5½	" 26	13 8	" 24	3 6¾
" 13	15 9	" 19	16 8	" 28	13 8½	" 26	4 0
" 14	16 0	" 21	17 1½	" 30	13 10	" 27	4 4½
" 16	16 8	" 22	17 3	" 31	13 10	" 28	4 9
" 17	17 0	" 23	17 4¾	June 2	13 10	May 1	5 6
" 18	16 10¾	" 24	17 3¾	" 3	13 9	" 9	7 9
" 20	16 9¾	" 25	17 2¾	" 4	13 7	" 22	9 4
" 21	16 8	" 26	17 0	" 7	13 4	" 25	9 5
" 23	16 3	" 28	16 6	" 8	13 3	June 2	9 8
" 24	15 11	1910		" 9	13 1	" 6	11 2¾
" 25	15 7¾	April 23	7 1	" 10	13 0	" 11	12 6
" 26	15 4¾	" 25	7 7	" 11	13 0	" 14	13 8
" 27	15 2¾	" 26	8 6	" 13	12 11½	" 16	14 8
" 28	14 11	" 27	9 1	" 14	12 11	" 17	15 0
" 30	14 7	" 28	9 8	" 15	12 10¾	" 21	16 1
July 1	14 4	" 30	10 5½	" 16	12 10¾	" 25	16 5
" 2	14 2	May 2	10 10	" 17	12 11¾	" 27	16 4
" 3	14 0	" 3	10 11	" 18	12 10¾	" 28	16 3¾
" 4	13 10½	" 4	10 11½	" 20	12 9	" 29	16 2¾
1909		" 5	11 0	" 21	12 9	July 1	16 0
June 2	11 3	" 6	11 1	" 23	12 6	" 3	15 8
" 4	11 11	" 7	11 3	" 25	12 2	" 6	15 0¾
" 5	12 7¾	" 9	11 9	" 27	11 11	" 10	14 1
" 6	13 2	" 11	12 4	" 28	11 8	" 13	13 4¾
" 8	14 1¾	" 12	12 10½	July 2	11 3	" 17	12 5
" 9	14 6	" 13	13 2½	" 3	11 3	" 21	11 7
" 10	14 9¾	" 14	13 4			" 24	10 11
" 11	15 2¾	" 16	13 7	1911		" 31	9 2
" 12	15 3	" 17	13 7	Mar. 22	7	Aug. 1	8 11
" 14	15 7	" 19	13 7	April 1	1 8	" 4	8 3
" 15	15 3	" 20	13 5	" 13	2 5	" 7	7 9¾
" 16	15 10	" 23	13 3½	" 18	2 5	Oct. 26	1 6

MISCELLANEOUS DISCHARGE MEASUREMENTS

In the course of the reconnaissance investigation conducted by the Commission of Conservation in 1911, 1912 and 1913, various stream discharge measurements were made. For streams north of the Railway Belt and on the Pacific coast, these constitute, in most cases, the only stream flow data available. Many miscellaneous measurements have also been made by the Provincial Water Rights Branch and the British Columbia Hydrometric Survey. Some measurements are also available from other sources. From these various data, those which would be of most value in the consideration of power projects have been selected for presentation here.

In this Report, relating as it does essentially to water-powers, it did not appear desirable to include a large number of miscellaneous measurements that have been made on the smaller irrigation streams. Data respecting these may be found in the *Annual Reports* of the Provincial Water Rights Branch, Victoria, and in the various *Water Resources Papers* of the Dominion Water Power Branch, Department of the Interior, Canada.

For some streams having power possibilities, and upon which regular gauging stations have been maintained or recently established, the data available were not of a character to permit summaries to be included in this report. However, certain discharge measurements were available, and, for the purpose of convenient reference, have been included in the following table.

An asterisk (*) indicates the streams on which regular gauging stations have been or are being maintained. Reference may be made to "List of Streams in British Columbia for which stream flow data are available," for the periods for which records exist.

In the table the streams are given in alphabetical order. In the first column the letters indicate to which main watershed or district the streams belong, thus: C.—Columbia river and tributaries (except Kootenay river); K.—Kootenay river and tributaries; F.—Fraser river and tributaries (except Thompson river); T.—Thompson river and tributaries; V.I.—streams on Vancouver Island; P.C.—streams on Mainland Pacific Coast (except Fraser river). These letters are the same as used in the "List of Streams in British Columbia for which stream flow data are available," and when used in connection with the column headed "Stream and Location of Measuring Section," will enable the situation of the measuring station to be readily found on the map.

MISCELLANEOUS DISCHARGE MEASUREMENTS

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	Sq. feet	Feet	Sec.-feet	
C	*Akolkolex river		Sept. 13, 1912	33	176	5·3	655	
F	Alexis creek (tr. Chilcotin)—at highway bridge, 2m. W. of Alexis Creek P.O.	G. H. Ferguson	Oct. 17, 1912	12	8·8		20·5	Water said to be high.
F	*Anderson river—near mouth	C. G. Cline	April 9, 1912	80	141	2·8	322	
	do.	do.	July 16, "	73	128	2·0	166	
	do.	do.	Sept. 27, "	60	127	1·6	76	
P.C.	Apple river (Loughborough inlet)—1½m. from mouth	Macdonald and Wand	Sept. 5, 1912	83	151		256	Float measurement, over 100-ft. course.
V.I.	Ash river—near junction with Stamp	F. W. Knewstubb	Feb. 20, 1913	95	298		1,019	Drains Ash, Dixon, Elsie and Deep lakes.
	do.		July 31, 1914			2·0	247	
	do.		Sept. 11, "			1·68	141	
	do.		Dec. 14, "			2·30	382	
C	*Ashnola river—just above road bridge, 1m. from mouth	J. C. Dufresne	Oct. 10, 1911	60	90		100	Low water, floats.
	do. at south line I.R. No. 10	O. J. Bergoust	Sept. 27, 1912	29	86		88	
	do. near Ashnola	K. G. Chisholm	July 28, 1914	57	111	0·10	192	
	do. do.	do.	Aug. 31, "	41	46	0·61	71	
	do. do	do.	Dec. 1, "	40	50	0·53	68	
F	Baker creek (near Quesnel)—at bridge near mouth	G. H. Ferguson	Aug. 6, 1912	25	22		10·4	
C	Beard creek (tr. upper Columbia)		July 15, 1912	6	3·4	0·66	4·3	
V.I.	Beaver creek—at waggon bridge	W. Maclachlan	Nov. 19, 1913	18·8	19·1		16·6	
C	Beaver creek—at Kaleden diversion dam	J. C. Dufresne	Aug. 13, 1913	2·2	1·5		5	Floats.
T	Beaver creek (tr. Clearwater)—at crossing Murtle trail		June 10, 1914				190	
F	Beaver creek (tr. Quesnel)—at bridge just above mouth	G. H. Ferguson	July 18, 1912	30	35		43	Flow is very small at low water.
P.C.	Bellakula river—at bridge	Macdonald and Wand	Oct. 4, 1912	230	2,380		13,330	
C	Bigmouth creek (tr. upper Columbia)—at mouth	F. W. Knewstubb	Oct. 29, 1912				250	Estimated flow—fairly low.
K	*Big Sand creek—3,000 ft. above C.P. Ry	H. B. Hicks	Oct. 17, 1912	12	13·3		33	
P.C.	Big Slide creek (tr. Skeena)—at Telegraph trail near mouth	G. H. Ferguson	Aug. 4, 1913	12	33		131	
F	Blackwater river—at Blackwater bridge	C. J. Vick	Aug. 26, 1912	28	196		350	
	do. 200 yds. above junction of Nasco	do.	Aug. 14, 1912	100	114		350	Good metering station. Includes flow Baezaeko, but not Nasco.
	do. below Chine lake	do.	Aug. 22, 1912				220	Floats, above Baezaeko.
	do. below fall below confluence of Kuskya river.	do.	Aug. 20, 1912	76	70		158	Good metering station.
T	*Botanie creek—above diversions	C. E. Richardson	Sept. 21, 1911	11	4·4	1·33	4·2	
	do. do.	C. B. Corbould	May 29, 1912	13	7·9	1·62	14·3	
T	Boulder creek (tr. N. Thompson)—1m. from mouth		Sept. 6, 1914			1·0	19·2	
C	Boulder creek (tr. Canoe river)—at mouth	F. W. Knewstubb	Oct. 22, 1912	32	47		87	Medium stage.
C	*Boundary creek—at Greenwood	C. Varcoe	July 10, 1912	33	46·8		130	
	do. at Granby smelter	do.	July 30, "	31	32·5		53	
	do. ½m. N. of Int. Bdy.	do.	Aug. 29, "	31	23·6		51	
F	Bowron (Bear) river—below cañon	A. W. Campbell	Aug., 1912				700	Estimated discharge.
P.C.	*Brandywine river (tr. Squamish)—1m. above mouth	C. G. Cline	May 27, 1915	25	81	2·90	256	
	do. do.	Hughes and Gordon	June 10, "	28	76	2·63	182	
	do. do.	do.	June 11, "	30	101	3·30	364	
	do. do.	H. C. Hughes	Aug. 16, "	30	76	2·68	210	
	do. do.	do.	Aug. 17, "	28	58	2·23	114	
	do. do.	do.	Dec. 9, "	26	94	1·90	67·5	
T	*Brash creek (tr. Shuswap)—above intake	K. G. Chisholm	April 3, 1915	20	19·2	4·90	63·1	
	do. do.	A. L. McNaughton	Sept. 8, "	9	3·2	3·90	2·8	
	do. do.	C. G. Cline	Oct. 28, "	10	4·6	4·10	6·5	

* A regular gauging station has been maintained on this stream; for records available consult "List of Streams in British Columbia for which Stream Flow Data are available with Index to Water Resources Papers."

* A regular gauging station has been maintained on this stream; for records available consult "List of Streams in British Columbia for which Stream Flow Data are available with Index to Water Resources Papers."

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
P.C.	Brem river (Toba inlet)—near mouth	C. J. Vick	July 7, 1913	175	824	......	2,570	Metered above high tide B.M. on spruce stump 10·3 ft. above water level.
P.C.	Brim river (Gardner canal)—near mouth	C. C. Lyall	Sept. 12, 1913	156	958		2,364	
V.I.	Browns river	F. W. Knewstubb	July 21, 1913	72	54	1·83	82	Metered at low tide.
K	*Bull river—in box cañon 6½m. above mouth	G. H. Ferguson	Sept. 4, 1911	27	413	......	932	Drainage area 17·8 sq. miles.
	do. at headworks of Bull River Power Co.	G. E. Henderson	Nov., 1910	......	......	......	467	Said to be minimum discharge observed during 7 years.
P.C.	*Bulkley river—at the ferry, Haselton	G. H. Ferguson	July 15, 1913	506	2,305	†	16,794	
	do. at G.T.P. Ry. bridge, just below Morice river	do.	Sept. 18, "	305	944	‡	4,916	
	do. at highway bridge at Silverthorne	Bird and Corbould	Sept. 19, "	45	88	......	80	
F	Butchers Flats creek (tr. Nechako)—outlet of Natleaby lake	A. W. Campbell	Sept. 20, 1912	......	......	......	4	
K	Campbell creek (tr. Kootenay lake)—at point ¼m. above mouth.	G. H. Ferguson	Oct. 21, 1911	7	12	......	32	
C	Canoe river—at mouth	F. W. Knewstubb	Oct. 14, 1912	......	......	......	1,350	Estimated flow.
C	*Cañon creek (tr. upper Columbia)	......	Aug. 3, 1912	56	58	1·80	205	
P.C.	Cañon creek (tr. Skeena)—½m. W. of Telegraph trail	G. H. Ferguson	Aug. 12, 1913	26	228	......	633	River falling.
P.C.	Cañon creek (tr. Bulkley)	G. H. Ferguson	Sept. 30, 1913	10	9·1	......	53	Floats, over 70-ft. course.
C	*Cariboo creek—near Burton city	C. E. Richardson	July 24, 1914	46	177	4·40	363	Affected by backwater.
	do. do.	Richardson and Elliott	Sept. 3, "	47	144	1·28	136	
	do. do.	J. A. Elliott	Oct. 30, "	63	172	1·75	303	
K	*Carpenter creek—near New Denver	Ward and Gill	April 16, 1914	199	97	1·9	541	
	do. do.	Elliott and Beeston	May 13, "	200	130	2·35	919	
	do. do.	Gill and Elliott	July 9, "	199	132	2·10	684	
	do. do.	D. O'B. Gill	Aug. 18, "	33	47	1·10	180	
	do. do.	Elliott and Beeston	Nov. 4, "	32	47	0·90	180	
T	*Celista creek (tr. Shuswap lake)	Tredcroft and Chisholm	Aug. 13, 1914	32	37	0·58	54·7	Regular section.
	do. do.	E. M. Dann	Aug. 29, "	19	15·4	0·35	23·4	At mouth.
F	*Chehalis river—just below outlet of lake	L. G. Swan	Oct. 10, 1911	......	......	1·11	205	
	do. do.	do.	Oct. 17, "	......	......	1·74	526	
	do. do.	do.	Oct. 20, "	......	......	1·56	412	
	do. do.	do.	Oct. 22, "	......	......	1·41	323	
	do. do.	do.	Oct. 24, "	......	......	1·26	271	
	do. do.	do.	Oct. 26, "	......	......	1·18	235	
	do. do.	do.	Oct. 30, "	......	......	1·04	183	
	do. do.	do.	Nov. 1, "	......	......	0·90	134	
	do. do.	do.	Nov. 3, "	......	......	0·86	128	
F	Chehalis river, W. Fork—1m. above forks	W. S. Wilson	Feb. 2, 1912	20	168	1·10	404	
F	Cheslatta Lake outlet (tr. upper Nechako)—at mouth	C. J. Vick	Sept. 14, "	......	......	......	30	Low summer flow, had been no rain for several weeks.
P.C.	Chewson creek (Toba inlet)—just above First cascades	C. C. Lyall	Aug. 20, 1912	25	46	......	295	B.M. copper tack 34·6 ft. above water surface on 24-inch fir, 30 ft. above cross section.
F	Chilako (Mud) river—in vicinity of Lot 989 on Telegraph trail.	A. W. Campbell	Sept. 21, 1912	45	62	......	33	
F	Chilko river—at mouth	G. H. Ferguson	Oct. 1912	......	......	......	1,800	Calculated from meterings on Chilcotin above and below mouth.
F	Chilcotin river—at old bridge at Hanceville	G. H. Ferguson	Oct. 8, 1912	228	718	......	2,095	

* See footnote, page 452.

† B.M. on nail in cottonwood stump 83 ft. north of river bank at ferry. Elev. of B.M. 753·5 ft. above sea level. River dropped 23 ft. in 49 days. Water surface at junction of Bulkley and Skeena 741·9 ft. above sea level.

‡ B.M. Elev. 1,873·9 ft. above sea level on 18-inch stump at S.E. end of bridge 100 ft. upstream. Water surface 1,866 ft. above sea level.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
	Chilcotin river—at bridge at Newton ranch, 3m. above Chilko.	G. H. Ferguson	Oct. 11, 1912	38	123	......	220	
P.C.	Chuckwalla river (Rivers inlet)—2m. from mouth	C. C. Lyall	Sept. 26, 1912	122	241	......	472	Low water, B.M. 17·1 ft. above water level, on 6-inch alder on right bank.
F	Clisbako river (tr. Nasco-Blackwater)—at mouth	C. J. Vick	Aug. 12, 1912	26	30·4		53	Good metering section.
F	Clucuis creek—on Lot 945	A. W. Campbell	Sept. 12, 1912	43	34	......	8·6	
C	Cold Spring creek—at Fairmont P.O.	G. H. Ferguson	Sept. 19, 1911	6	2·7	......	6	
C	*Columbia river—at Spillimacheen	H. C. Hughes	May 30, 1912	163	1,760	3·55	2,000	
	do. do.	do.	June 17, "	230	2,550	7·78	4,300	
	do. do.	do.	June 20, "	230	2,710	8·54	4,860	
	do. do.	do.	July 4, "	235	2,820	8·64	6,230	
	do. do.	do.	July 17, "	230	2,760	8·36	6,000	
	do. do.	C. E. Richardson	Sept. 30, "	140	1,510	3·02	1,210	
F	*Columbia river—at Athalmer	H. C. Hughes	May 28, 1912	121	238	2·30	340	
	do. do.	do.	June 12, "	149	364	3·39	382	
	do. do.	do.	June 29, "	157	614	5·06	1,180	
	do. do.	do.	July 22, "	160	580	4·52	902	
	do. do.	C. E. Richardson	Sept. 28, "	137	240	2·43	410	
F	*Coquitlam river—above lake		Oct. 27, 1912	80	200	2·55	322	
F	Cottonwood river (near Quesnel)—at highway bridge, ½m. from Boyd's ranch.	L. G. Mills	Aug. 12, 1912	85	220	......	661	Water surface 12·8 ft. below B.M. on downstream side of bridge.
V.I.	*Cowichan river—metered 175 ft. below Gov't. bridge near Duncan.	H. B. Hicks	Dec. 13, 1911	160	627	5·20	2,910	
	do.	F. W. Knewstubb	Jan. 29, 1913	156	522	4·55	1,675	
V.I.	Cruikshank river	F. W. Knewstubb	Aug. 5, 1913	......	136	......	456	
C	Cummins creek (tr. upper Columbia)—just above trail bridge near mouth.	F. W. Knewstubb	Sept. 29, 1912	42	71	......	171	Metered. Fairly low.
K	Cultus creek (tr. Kootenay lake)—½m. upstream from its mouth.	G. H. Ferguson	Oct. 23, 1911	37	76	......	64	
C	Davie creek (tr. upper Columbia)—at trail crossing	F. W. Knewstubb	Oct. 31, 1912	......	......	......	7	Estimated flow.
K	Davis creek (tr. Kootenay lake)—at mouth near Lardeau	G. H. Ferguson	Oct. 18, 1911	13	6·2	......	40	
P.C.	Dead Horse creek (tr. Skeena)—Mile 54, Telegraph trail	G. H. Ferguson	July 31, 1913	17	13·5	......	49	Floats, over 30-ft. course.
P.C.	Dean river (Dean channel)—near mouth	Macdonald and Wand	Oct. 12, 1912	192	568	......	1,412	Very low.
K	Dibble creek (tr. Bull)—at mouth	G. H. Ferguson	Sept. 9, 1911	27	16	......	43	
P.C.	Dome river (Aaltanhash inlet)—near mouth	C. J. Vick	Sept. 17, 1913	46	90	......	490	Floats, over 60-ft. course.
P.C.	Doos river (tr. Owekano lake)—at mouth	Simpson and Vick	Sept. 4, 1913	160	750	......	675	Surface floats, over 50-ft. course. Water level at section depends on height of lake, not on discharge.
F	*Dore river (tr. upper Fraser)—near McBride	K. G. Chisholm	July 2, 1915	120	350	4·63	1,660	
	do do.	Elliott and Challies	Aug. 21, "	110	306	4·10	1,340	Shift in channel.
	do. do.	J. A. Elliott	Sept. 19, "	108	264	3·90	1,240	
P.C.	Driftwood creek (tr. Bulkley)	G. H. Ferguson	Sept. 30, 1913	37	30	......	79	Floats, over 47-ft. course.
V.I.	Drinkwater river—at Della lake	F. W. Knewstubb	Oct. 29, 1913	6·6	3·8	......	5·2	
	do. at Upper cañon	do.	Oct. 30, "	20	27·8	......	108	
	do. above Lower cañon	do.	Nov. 2, "	47·3	106	......	54	
K	*Duncan river—near Howser		Nov. 27, 1914	......	......	1·80	1,250	
	do.	G. K. Beeston	Mar. 5, 1915	271	1,440	0·78	477	
	do.	C. B. Corbould	May 5, "	309	2,430	4·20	4,450	
	do.	H. O. Dempster	July 21, "	320	2,930	6·20	7,240	
	do.	do.	Oct. 27, "	283	1,740	2·05	1,410	

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	Sq. feet	Feet	Sec.-feet	
C	*Dutch creek (tr. upper Columbia lake)—at highway bridge, 1m. above mouth.	G. H. Ferguson	Sept. 19, 1911	37	106	....	279	Water surface 5·1 ft. below B.M. on sill at south end of bridge.
C	*Dutch creek (tr. upper Columbia lake)—near mouth	O. J. Bergoust	July 30, 1912	45	137	....	450	
	do. do.	do.	Nov. 3, "	40	132	....	1,184	
	do. near Fairmount Springs	D. O'B. Gill	May 8, 1914	42·5	120	1·20	305	
	do. do.	O. J. Bergoust	April 10, "	......	122	0·40	104	
	do. do.	do.	May 19, "	......	214	1·70	719	
	do. do.	J. A. Elliott	June 18, "	93	386	3·00	2,760	
	do. do.	do.	Aug. 1, "	70	146	1·58	525	
	do. do.	O. J. Bergoust	Sept. 22, "	......	91	0·98	217	
	do. do.	J. A. Elliott	Oct. 20, "	34	90·6	0·98	221	
	Dutch creek—1st North fork	O. J. Bergoust	Aug. 4, 1912	18	20	....	60	
	do. do.	do.	Oct. 22, "	18·5	16·2	1·1	32·4	
T	*Eagle river—near Sicamous	C. E. Richardson	Aug. 23, 1911	130	600	4·42	1,075	
	do. do.	do.	Oct. 10, "	133	450	3·15	616	
	do. do.	do.	Feb. 29, 1912	115	341	2·07	253	
	do. do.	H. C. Hughes	May 21, "	212	1,746	10·01	5,340	
	do. do.	C. E. Richardson	June 17, "	200	1,700	10·06	5,200	
	do. do.	do.	July 12, "	202	1,050	6·95	2,100	
	do. do.	do.	Sept. 7, "	136	675	4·5	1,362	
	do. do.	do.	Oct. 5, "	133	497	3·55	870	
	do. do.	Dann and Chisholm	Oct. 24, 1913	......	......	....	1,427	
K	*Elk river—at highway bridge, 1m. E. of Fernie	G. H. Ferguson	Aug. 30, 1911	162	503	....	1,646	Water surface 4·75 ft. below B.M. in south abutment of bridge.
	do. at Elko	H. J. Haffner	Feb. "	......	......	....	500	Said to be minimum value of discharge.
	do. at highway bridge, 1m. S. of Kragg	G. H. Ferguson	Aug. 24, "	257	519	....	2,188	Water surface 8·2 ft. below B.M. in cribwork at N. end of bridge.
	Elk river—1½m. above Elko	W. J. E. Biker	Oct. 16, 1912	125	276	....	824	
	Elk river—1¾m. above Elko	H. B. Hicks	Sept. 19, 1913	145	349	3·7	1,336	
P.C.	Elliot creek (tr. Southgate river, Bute inlet)—near mouth	Macdonald and Wand	Aug. 29, 1912	45	120	....	293	Float measurement. B.M. 8 ft. above water surface on 12-inch spruce 300 ft. from mouth on L. bank.
C	Ellis creek (tr. Okanagan)—2m. above mouth	F. H. Latimer	Oct. 1910	70	50		107	Floats.
H	Fairy creek (near Fernie)—at waterworks dam	G. H. Ferguson	Aug. 23, 1911	25	10·3	....	60	
K	*Findlay creek—near falls		April, 1911			....	88	
C	Flat creek (tr. 'big bend' Columbia)—at mouth	F. W. Knewstubb	Oct. 29, 1912	......	......	....	200	Estimated flow.
P.C.	Forbes river (Homfray channel)—30 ft. above tide water	C. C. Lyall	Aug. 19, 1912	70	86	....	133	B.M. 3·9 ft. above water surface, on boulder 30 ft. upstream from tide water.
C	*Forster (No. 2) creek—near Forster landing	H. C. Hughes	May 29, 1912	32	64	0·84	314	
	do.	do.	June 13, "	53	114	1·70	741	
	do.	do.	July 3, "	54	114	1·68	689	
	do.	do.	July 24, "	57	116	1·70	745	
	do.	C. E. Richardson	Sept. 28, "	32	43	0·40	203	
	do.	Richardson and Elliott	May 16, 1913	35	402	0·54	184	Gauge shifted 0·1.
	do.	J. A. Elliott	June 19, "	90	161	1·55	930	New gauge.
	do.	C. E. Richardson	July 11, "	88	155	1·70	1,090	Different section.
	do.	J. A. Elliott	July 15, "	90	209	2·00	1,380	do.
	do.	do.	July 30, "	90	130	1·00	756	

*See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
	Forster (No. 2) creek—near Forster landing	Richardson and Swan	Sept. 3, 1913	70	73	0·50	404	
	do.	J. A. Elliott	Sept. 13, "	70	71	0·42	437	Different section.
	do.	C. E. Webb	Nov. 27, "	34·5	36	0·22	120	
	do.	D. O'B. Gill	May 4, 1914	35	70	0·25	366	
	do.	J. A. Elliott	June 19, "	86	240	2·25	1,730	
	do.	do.	Aug. 2, "	90	170	1·70	997	
	do.	do.	Oct. 22, "	33	79	1·0	164	New section.
	do.	C. B. Corbould	Feb. 26, 1915	27	64	0·82	78	
	do.	J. A. Elliott	May 1, "	33	91	1·45	305	
	do.	do.	May 23, "	33	104	1·65	395	
	do.	do.	July 8, "	33	136	2·40	987	
	do.	C. E. Richardson	Oct. 23, "	33	76	0·96	151	
T	*Fortune creek—near Armstrong	do.	Aug. 29, 1911			0·82	4·1	
	do.	do.	Oct. 9, "			0·80	2·4	
	do.	do.	May 21, 1912	30	39	1·76	159	
	do.	do.	June 15, "	32	48	2·01	219	
	do.	do.	June 20, "	22	23	1·00	86	
	do.	do.	July 12, "	17	13	0·53	15·6	
	do.	do.	Sept. 7, "	13	7·7	0·6	13·9	
	do.	do.	Oct. 5, "	6·4	1·5	0·36	1·8	
F	Four-mile creek (near Quesnel)—outlet 10-mile lake	G. H. Ferguson	Aug. 22, 1912	3·6	1·1		1·3	Suggested source of water supply for Quesnel.
V.I.	Franklin river (Alberni canal)	F. W. Knewstubb	Oct. 22, 1913	114	142		180	
F	*Fraser river—metered near Agassiz	E. Davis	Jan. 31, 1912	1,015	7,780		28,785	
K	*Fry creek—near Kaslo		Nov. 29, 1914			2·1	278	
	do. near Johnston landing	Richardson and Elliott	Mar. 23, 1915	76	123	0·60	179	At wading section.
	do. do.	J. A. Elliott	April 1, "	74	185	0·60	193	At cable section.
	do. do.	C. B. Corbould	May 10, "	90	455	5·47	2,280	
	do. do.	H. O. Dempster	July 24, "	94	455	5·05	1,990	
	do. do.	do.	Oct. 29, "	74	250	2·28	484	
P.C.	Galnaskeask creek (tr. Skeena)—at mouth	G. H. Ferguson	Aug. 24, 1913	80	310		2,200	Water very high, rough measurement with floats.
K	Glacier creek (tr. Trout lake)—at power plant						3·4	Lowest known discharge.
K	*Glacier creek—near Howser		Nov. 27, 1914			4·3	142	Old gauge.
	do. do.	C. B. Corbould	May 5, 1915	36	119	1·80	309	New gauge; datum 3·25 above old gauge.
	do. do.	H. O. Dempster	July 21, "	37	115	3·00	1,390	
	do. do.	do.	Oct. 27, "	27·5	76	1·65	195	
K	*Goat river—2m. below Cameron creek	R. C. Eakin	April 1911				60	
P.C.	Goat creek (tr. Telkwa)—½m. above mouth	Ferguson and Bird	Sept. 13, 1913	28	34		77	
K	*Gold creek—6m. N. of Newgate, at Davis cabin, 5m. from mouth	C. C. Lyall	Aug. 30, 1911	37	49·4	3·12	154	Said to be low water.
	do. North fork, at mouth	do.	Aug. 31, 1911	35	32·5	2·28	74	
P.C.	Gold creek (tr. Skeena)—at bridge, 2m. above Kitselas	A. J. McPherson	Oct. 11, 1913	62	153		804	
C	Goldstream West ('big bend' Columbia)—at foot of cañon, near mouth	F. W. Knewstubb	Nov. 11, 1912	44	99		430	Fairly low.
C	Goose Grass creek ('big bend' Columbia)—near mouth	F. W. Knewstubb	Sept. 30, 1912	11·7	9·4		21	Medium stage.
C	Gordon creek (tr. 'big bend' Columbia)—6m. from mouth	F. W. Knewstubb	Nov. 2, 1912	28	22		25	Fairly low.
C	Gordon river—metered at Newton, No. 1 Camp	G. Gray Donald	Mar. 10, 1911	120	827	2·25	1,863	
	do. do.	C. W. Roberts	Oct. 17, 1911	113	634	2·78	1,760	
C	*Granby river (N. Fork Kettle)—at smelter	C. Varcoe	Nov. 4, 1911	47	161		145	Low water.

* See footnote, page 452.

C	*Granby river (N. Fork Kettle)—at smelter	C. Varcoe	Nov. 4, 1911	47	161		145	Low water.

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	Sq. feet	Feet	Sec.-feet	
P.C.	Granite creek (Skeena)	G. H. Ferguson	Oct. 13, 1913	8	2·8		9	Surface floats over 35-ft. course.
F	*Green river—at Green lake	H. J. E. Keys	Nov. 22, 1913	26	51	1·32	152	Station established, gauge not referenced.
	do.	do.	Mar. 17, 1914	33	58	1·47	157	Surface measurement. Former gauge gone. New gauge put in and referenced.
	do.	Keys and Hughes	May 28, "	37	97	2·00	422	
	do.	H. C. Hughes	July 21, "	39	93	2·32	522	
	do.	do.	Aug. 15, "	39	89	2·15	435	
	do.	do.	Sept. 10, "	34	73	1·35	215	
	do.	Dobbie and Hughes	Dec. 5, "	40	102	1·80	243	Channel changed by freshet and logs wedged under bridge.
K	Hamill creek (near Lardeau)—at Stevenson's camp, 2m above mouth.	G. H. Ferguson	Oct. 19, 1911	23	43		150	Floats.
C	Harvey creek (Canoe river)—near mouth	F. W. Knewstubb	Oct. 16, 1912	30	45		141	Metered. Fairly low.
V.I.	*Haslam creek—metered 500 ft. below Colliery Ry. bridge	F. W. Knewstubb	Feb. 12, 1913	23·6	30	1·70	46·3	
P.C.	Hasel creek (tr. Toba river)—near mouth	W. A. Wand	Aug. 23, 1912	32	38		131	Float measurement.
P.C.	Homathko river—100 yards from tide flats	Macdonald and Wand	Sept. 2, 1912	530	7,853	†	10,369	
C	Horne creek ('big bend' Columbia)—near mouth	F. W. Knewstubb	Nov. 4, 1912	28	32		51	Metered. Fairly low.
F	Horsefly river (tr. Quesnel lake)—at Harper camp	A. W. Campbell	July 31, 1912	143	385		1,030	
	do. at Blackcreek falls, 24m. above Harper						776	
C	*Horse Thief creek (tr. upper Columbia)—at highway bridge ½m. above mouth.	G. H. Ferguson	Sept. 21, 1911	123	203		383	Water surface 6·2 ft. below B.M. on lower stringer on downstream side of S. end of bridge.
C	*Horsethief creek (tr. upper Columbia)—near mouth							
	do. do.	H. C. Hughes	May 29, 1912	68	129	1·70	484	
	do. do.	do.	June 13, "	97	222	2·00	1,180	
	do do.	do.	July 3, "	95	226	1·90	1,170	
	do. do.	C. E. Richardson	Sept. 28, "	61	119	1·22	252	
	do. do.	Richardson and Elliott	May 16, 1913	60	134	1·20	271	
	do. do.	C. E. Richardson	June 2, "	87	268	2·65	2,140	
	do. do.	J. A. Elliott	June 19, "	85	220	2·22	1,410	
	do. do.	C. E. Richardson	July 11, "	85	225	2·25	1,500	
	do. do.	J. A. Elliott	July 25, "	85	253	2·50	2,180	
	do. do.	do.	July 30, "	83	200	2·00	1,430	
	do. do.	C. E. Richardson	Sept. 3, "	82	200	1·95	850	
	do. do.	J. A. Elliott	Sept. 13, "	77	186	1·88	770	
P.C.	Huaskin Lake outlet (Drury inlet)—200 ft. from mouth	C. E. Webb	Sept. 27, "	55	98		147	Gauge frozen in.
P.C.	Icknа creek (S. Bentinck arm)	Macdonald and Lyall	Sept. 21, 1912	7	8		24	Float measurement.
C	Incameep creek—½m. above middle Incameep Indian village	Westover and Lyall	Oct. 5, 1912	65	198		421	Float measurement.
	do. do.	J. C. Dufresne	Sept., 1911	5	0·5		3	Float measurement.
C	*Incomappleux river	do.	June, "	20	20		60	Float measurement.
C	*Inonoaklin creek—near mouth		Sept. 16, 1912	96	570		1,520	
	do. at Edgewood	D. C. Jennings	Nov. 3, 1911				61	
	do. do.	C. E. Richardson	May 29, 1915	52	224	3·30	808	
	do. do.	H. O. Dempster	June 24, "	52	132	1·30	265	
	do. do.	do.	Sept. 16, "	45	69	0·29	54	
K	*Kaslo creek—at power plant	do.	Oct. 1, "	44	61	0·09	41	
C	Keremeos creek—at junction of roads, 9m. from Keremeos		Feb., 1902				48	Low water flow.
C	*Kettle river—at Grand Forks	J. C. Dufresne	Aug. 13, 1913	12	8·6		12	Floats.
		C. Varcoe	Oct. 19, 1911	170	304		304	

* See footnote, page 452.
† B.M. copper tack, 5·9 ft. above water surface, on 14-in. spruce, W. bank, 100 yards from tide flats.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
	*Kettle river—at Midway	C. Varcoe	Sept. 3, 1912	209	443		432	
C	*Kicking Horse river—at Palliser		June 4, 1913	110	310	2·1	920	
	do. do.		June 27, "	150	840	5·77	6,070	
	do. do.		Aug. 15, "	125	410	3·42	2,140	
P.C.	Kildalla river (Rivers inlet)—6m. from mouth	W. A. Wand	Sept. 26, 1912	116	614	‡	259	Low water.
P.C.	Kimsquit river (Dean channel)—½m. from mouth	C. C. Lyall	Oct. 14, 1912	93	340		1,000	Water very low. Metered at low limit.
P.C.	Kingcome river (Kingcome inlet)—near mouth	Macdonald and Wand	Sept. 18, 1912	475	2,018		6,077	
P.C.	Kispiox river (tr. Skeena)—at bridge near mouth	G. H. Ferguson	July 18, 1913	212	730		5,088	B.M. on top of centre cross beam 14·5 ft. above water.
P.C.	Kitsumgallum river (tr. Skeena)	G. H. Ferguson	Oct. 14, 1913	417	1,440	¶	4,617	
P.C.	Klinaklini river (Knight inlet)—below Indian huts	Westover and Wand	Sept. 16, 1912	310	2,730		15,636	
C	Klisilkwa creek (tr. Skagit)—at mouth	J. C. Dufresne	Aug. 26, 1913	25	22		30	Estimated flow.
P.C.	Klite river (tr. Toba)—100 ft. from mouth	Westover and Lyall	Aug. 21, 1912	75	608		972	Floats. B.M. copper tack in top beam S.E. corner cabin 7·85 ft. above water surface.
P.C.	Koeye Lake outlet (Fitzhugh sound)	Macdonald and Wand	Sept. 30, 1912	70	160		416	Float measurement.
V.I.	Kokish river—near mouth at low tide	B. N. Simpson	Sept. 25, 1913	50	78		205	
K	*Kootenay river—about ½m. above upper Bonnington falls		Jan., 1905				5,822	
	do. at ferry 1m. N. of Int. Bdy. at Gateway	G. H. Ferguson	Aug. 26, 1911	386	2,349		9,234	Water surface 13·5 ft. below B.M. established in Ferryman's shanty and 8 ft. below high water mark.
	do. at highway bridge at Canal flats	do.	Oct. 10, 1911	130	877		1,420	Water surface 11·6 ft. below B.M. on top timber of south abutment of bridge.
	do. near Libby, Mont.		Mar. 15, 1911				3,900	
	do. do.		July 31, "				18,900	
	do. do.		Oct. 10, "				5,630	
	do. near Taghum		Nov. 16, 1914				27,300	
	do. do.		Dec. 8, "				23,400	
K	Lardeau river—at C.P. Ry. bridge, ½m. south of Howser	G. H. Ferguson	Oct. 13, 1911	110	311		798	Water surface 20·45 ft. below base of rail at S. end of bridge.
K	do. near Howser		Nov. 28, 1914				1,130	
P.C.	Link river—Ocean Falls	Engineers' report	Winter, 1910				274	Probably a low-water reading.
K	*Linklater creek—at mouth	C. C. Lyall	Aug. 28, 1911	7·6	4·5		11·8	Said to be low water.
K	*Little Sand creek—1½m. above Big Sand creek	H. B. Hicks	Oct. 23, 1911	22	14		24	
	do. by highway bridge from Jaffray	H. L. Robbin	June 28, 1913	24	33	1·16	114	
	do. do.	do.	Aug. 27, "	24	19	0·62	38	
	do. do.	do.	Oct. 20, "	24	14	0·05	23	
K	Lower Duncan river—at 2m. above Lardeau	G. H. Ferguson	Oct. 20, 1911	164	1,416		1,921	From small boat
P.C.	Maloney creek (tr. 'big bend' Columbia)—near mouth	F. W. Knewstubb	Oct. 29, 1912	44	62		162	Metered. Fairly low.
C	Manitou creek (Dean channel)—20 yds. from mouth	C. C. Lyall	Oct. 12, 1912	15	16		38	Floats. Water fairly high.
C	McIntyre creek (tr. Okanagan)—1m above mouth	J. C. Dufresne	April 29, 1911	18	12		39·6	Beginning to flood. Floats.
	do. below junction North fork	do.	Aug. 15, "	12	13		9·4	Low summer flow. Meter.
C	McLean creek—just below falls	J. C. Dufresne	Oct. 7, 1910	8	1		1·2	Floats.
P.C.	*Mesliloet river—near mouth	C. G. Cline	Mar. 13, 1912	72	62·4	1·82	108	
	do. do.	do.	July 10, "	80	154	2·35	291	
	do. do.	do.	Aug. 21, "	70	78·5	2·25	204	
	do. do.	do.	Oct. 17, "	140	392	3·65	1,090	

* See footnote, page 452.
‡ B.M. on 10-inch cottonwood on R. bank. Elev. 15·5 ft. above water surface.
¶ B.M. on bridge seat at east end of bridge, elev. 190·3 ft. Water surface elev. 173 ft.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
	*Mesliloet river—near mouth	C. G. Cline	Oct. 18, 1912	118	350	2·96	615	
C	Mica creek (tr. 'big bend' Columbia)—near mouth	F. W. Knewstubb	Oct. 29, 1912	....		....	30	
P.C.	Midway creek (head of Bute inlet)—¼m. from mouth	Macdonald and Wand	Aug. 31, 1912	54	124	....	656	Float measurement.
V.I.	Millstone river—at downstream face, E. & N. Ry. bridge	F. W. Knewstubb	Feb. 13, 1913	19·6	40	1·57	39	
P.C.	Mink creek (Loughborough inlet)—near mouth	W. A. Wand	Sept. 5, 1912	23	23		100	Floats, over 100-ft. course.
C	Molson creek—2m. above junction with Wood river	F. W. Knewstubb	Oct. 18, 1912	32	32		71	Metered. Fairly low.
P.C.	Morice river (tr. Bulkley)—at mouth	G. H. Ferguson	Sept. 18, 1913	....	....		4,836	Calculated difference between Bulkley above and below Morice river mouth.
P.C.	Moses creek (Rivers inlet)—below falls	Westover and Lyall	Sept. 27, 1912	62	92	....	199	Floats. River very low.
C	Mosquito creek (Upper Arrow lake)	D. C. Jennings	Nov. 6, 1911	....	....	....	90	After 2 days' rain and snow.
K	Mountain stream No. 1—¼m. above mouth	G. H. Ferguson	Sept. 28, 1911	....	....	....	15	
K	Mountain stream No. 2—¼m. above mouth	G. H. Ferguson	Sept. 28, 1911	....	....	....	50	
K	*Moyie river—at C.P. Ry. bridge, Kingsgate	H. B. Hicks	Nov. 13, 1912	125	266	....	399	With floats.
	do. do.	do.	Nov. 16, "	20	16	....	39	do.
K	Upper Moyie river	Upper Moyie Elec. Co.	Oct. 20, 1910		....	....	76·9	
	do.	do.	Nov. 9, "		....	....	73·4	
	do.	do.	Dec. 10, "		....	....	73	
	do.	do.	Dec. 22, "		....	....	58·7	
	do.	do.	Jan. 10, 1911		....	....	57·5	
	do.	do.	Jan. 15, "		....	....	55·0	
	do.	do.	Feb. [illegible], "		....	....	51·9	
	do.	do.	Feb. [illegible], "		....	....	51·9	
	do.	do.	Feb. [illegible], "		....	....	51·9	
P.C.	Mud creek (tr. Bulkley)—near mouth	G. H. Ferguson	[illegible] 3, 1913	25	20	....	70	Floats, over 50-ft. course.
C	Muddy creek (tr. Similkameen)—at trail crossing near mouth.	J. C. Dufresne	[illegible] 26, 1913	20	10	....	10	Low summer flow. Floats.
P.C.	Nagle creek (tr. 'big bend' Columbia)—near mouth	J. C. Dufresne	Oct. [illegible], 1912	36	40	....	129	Metered. Fairly low.
V.I.	Nahmint river (Alberni canal)—2m. from mouth	F. W. Knewstubb	Feb. 24, 1913	78	187	....	473	
	do.	do.	Aug. 15, "	68	151	88·51	234	
	do. at section of Feb. 24, 1913	do.	Aug. 22, "	90	117	88·34	152	
	do. near outlets of Nahmint lake	do.	Sept. 22, "	88	280	....	221	
	do. 4½m. from mouth	do.	Aug. 22, "	80	123	....	178	
F	Nasko river—at junction with Blackwater	C. J. Vick	Aug. 15, 1912	100	84	....	160	Section about ¼m. above mouth.
	do. below junction with Clisbako	do.	Aug. 12, "	32	43	....	100	
	do. above junction with Clisbako, below rapids.	do.	Aug. 12, "	50	56	....	53	Good metering section.
F	*Nechako river—at ferry below Fraser Lake outlet	C. J. Vick	Sept. 4, 1912	250	3,205	....	7,125	Low summer flow.
	do. at ford 3m. below Tetachuck lake	do.	Sept. 20, "	250	620	....	2,000	Floats, over 100-ft. course.
P.C.	Necleetsconnay river (tr. Bellakula)—at bridge near mouth	Macdonald and Wand	Oct. 7, 1912	145	307	....	1,912	
C	Nehumpshon creek (tr. Similkameen)—at mouth of cañon	J. C. Dufresne	Oct. 17, 1911	18	8	....	18	Very low. Meter.
F	Niagara river (tr. Quesnel lake)—about 4m. above mouth	W. Lang Muir	Dec. 14, 1912	78	205	....	246	Stream 3 ft. below high-water level.
T	*Nicola river—1m. above Nicola lake	A. G. Woolsey	May 27, 1913	35	149		529	
	do. do.	do.	June 6, "	35	157		589	
	do. 400 ft. below Douglas lake	do.	June 30, "	64	180		370	
	do. above Nicola lake	E. M. Dann	May 6, 1913	37	86	1·70	227	
	do. do.	A. L. McNaughton	June 10, "	36	101	1·95	313	
	do. do.	do.	July 27, "	40	45	1·20	117	
	do. do.	Cline and McNaughton	Dec. 19, "	36	63	Ice	36	
V.I.	Nitinat river—500 ft. above Mullets camp, [illegible] C.N.P. Ry.	F. W. Knewstubb	Feb. 3, 1913	117	272	....	414	
P.C.	Nociek river (South Bentinck arm)—400 [illegible]	Westover and Lyall	Oct. 7, 1912	120	530	....	1,745	Water fairly high.

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	Sq. feet	Feet	Sec.-feet	
T	*North Thompson river—C.N. Ry. bridge, near mouth		Aug. 21, 1914				17,775	
P.C.	Noscall river (Dean channel)—100 yds. below cañon	Macdonald and Wand	Oct. 11, 1912	87	1,846		2,547	Water surface 11·9 ft. below B.M. on 8-in. spruce on W. bank.
C	*No. 2 (Forster) creek—at the upper bridge at Forster's ranch.	G. H. Ferguson	Oct. 5, 1911	38	81		336	Water surface 12·45 ft. below B.M. in timber at S. end of bridge.
P.C.	Nusash river (Dean channel)—near mouth	Macdonald and Wand	Oct. 11, 1912	57	84		258	Float measurement.
C	*Okanagan river—at Okanagan falls	J. C. Dufresne	Sept. 29, 1910	102	100		204	Meter measurement.
K	Palliser river (tr. upper Kootenay)—at mouth of cañon ½ mile above mouth.	G. H. Ferguson	Sept. 26, 1911	108	152		324	Water surface 7·9 ft. below B.M. on spruce tree on N. bank of river.
P.C.	Peavine creek (tr. Kispiox-Skeena)—near mouth	G. H. Ferguson	July 23, 1913	12	7·8		10	Floats, over 50-ft. course.
C	Penticton creek—at diversion dam, 2m. from mouth	F. H. Latimer	June 9, 1910	40	30		106	Floats.
	do.	do.	Oct., 1910	8	4		6	1 sec.-ft. from S. fork included.
K	Perry creek—at lower cañon	R. C. Eakin	April, 1911				35	
K	*Phillipps creek—at highway bridge at Roosville	G. H. Ferguson	Aug. 28, 1911	10·6	9·2		20·8	About normal discharge.
P.C.	Phillipps river (Phillipps arm)—near mouth	Macdonald and Wand	Sept. 5, 1912	330	2,400		723	B.M. copper tack 5·3 ft. above water surface, in spruce on W. bank ½m. from mouth.
P.C.	Porphyry creek (tr. Bulkley)—at highway bridge	G. H. Ferguson	Oct. 3, 1913	22	29		92	Floats, over 35-ft. course.
C	Powers creek—1m. from mouth	O. F. D. Norrington	July 8, 1913	14	12		38	Said to carry 10 sec.-ft. at low water. Metered.
V.I.	Price creek—at mouth	J. Moncton Case	Oct. 8, 1913	45	95		113	Floats.
V.I.	*Puntledge river—300 ft. above Logging Ry. bridge	H. B. Hicks	Jan. 3, 1912	161	364	2·22	909	
	do.	F. W. Knewstubb	Mar. 7, 1913	165	447	2·93	1,414	
	do.	do.	July 31, "	155	221	1·58	410	
V.I.	Qualicum river—at E. & N. Ry. crossing	F. W. Knewstubb	Mar. 3, 1913	48	66	2·19	184	
	do. do.	do.	Aug. 7, "	39	54	0·88	48	
F	Quesnel river—at highway bridge at Quesnel	L. G. Mills	Aug. 10, 1912	441	2,305		14,958	River surface 23·6 ft. below B.M. in lower sill on N. side of bridge.
	do. South fork—at highway bridge at Quesnel Forks.	C. H. Ferguson	July 23, 1912	263	941		7,622	Gates at dam at foot of Quesnel lake all open.
	do. North fork—at old bridge 1m. above Forks.	G. H. Ferguson	July 29, 1912	83	1,038		4,457	River falling after flood season.
V.I.	Quinsam river—near mouth	J. Monckton Case	Oct. 12, 1913	55	55		122	Approximate by floats.
T	*Raft river (tr. North Thompson)—1m. from mouth	E. H. Tredcroft	June 2, 1914	105	494	8·00	2,703	
	do.	do.	July 26, "	80	135	4·35	277	
	do.	Tredcroft and Corbould	Aug. 28, "	67	72	3·55	85	
	do.	E. H. Tredcroft	April 27, 1915	108	322	6·25	1,340	
	do.	do.	May 24, "	106	480	8·05	2,760	
	do.	A. L. McNaughton	Oct. 26, "	73	121	4·20	280	
P.C.	Roscoe river (at head Roscoe inlet)—near mouth	W. A. Wand	Oct. 16, 1912	66	247		840	Float measurements.
F	*Rutherford creek (tr. Green river)	H. C. Hughes	Aug. 12, 1914	48	123	3·32	840	
	do.	do.	Sept. 9, "	45	66	2·28	290	
	do.	do.	Sept. 10, "	45	86·4	2·80	446	
	do.	Dobbie and Hughes	Nov. 27, "	45	67·8	2·40	346	Channel probably changed by freshet
	do.	C. E. Dobbie	Jan. 19, 1915	21	19·6	1·25	57	Section below highway bridge, wading measurements.
	do.	Dobbie and Hughes	Feb. 5, "	22	28·0	1·13	44	
	do.	C. E. Dobbie	Mar. 17, "	52	72·0	1·90	164	Foot bridge.
	do.	do.	Mar. 16, "	41	58·0	1·90	203	Highway bridge.
	do.	do.	April 12, "	42	76·6	2·55	418	Foot bridge.
	do.	do.	April 20, "	44	98·0	2·95	668	do.
	do.	Cline and Dobbie	April 29, "	42	78·8	2·45	370	do.
	do.	C. G. Cline	May 25, "	43	71·8	2·85	413	Foot bridge, surface velocities.

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
K	*St. Mary river—highway bridge at St. Eugene mission	G. H. Ferguson	Oct. 11, 1911	232	422		1,035	Water surface 12·4 ft. below B.M. at north end of bridge.
F	San Jose creek—at outlet of lac la Hache	A. W. Campbell	Oct. 22, 1912	30			8	
C	Salmon river (tr. Pend-d'Oreille)—highway bridge at mouth.	W. S. Wilson	Oct. 26, 1912	22	164		404	High water in Pend-d'Oreille affects levels in this river. Station not suitable for permanent gauging station.
	do.	do.	Nov. 1, "	26	236		951	
	do.	do.	Jan. 31, 1913	22	137		296	
	do.	do	Mar. 22, "	19	147		250	
	do.	Biker and Lawley	June 26, "	42	804		2,625	
	do.	do.	Aug. 5, "	23	183		504	
	do.	do.	Sept. 3, "	20	134		363	
P.C.	Salmon river (Bute inlet)—½m. from mouth	B. N. Simpson	July 30, 1913	115	470		2,138	River at medium stage.
V.I.	Salmon river (Johnstone strait)—100 yds. above store, 2m from mouth.	C. J. Vick	Oct. 24, 1913	200	829		1,828	Low stage. Water surface 14 ft. below B.M. on 18-inch spruce on E. bank 50 yds. above section.
C	Sumallow river (tr. Skagit)—near mouth	J. C. Dufresne	Aug. 26, 1913	60	56		96	Low summer flow. Floats.
K	*Big Sand creek—½m. above falls	C. C. Lyall	Sept. 3, 1911	24	18		59	
P.C.	Sandie Lake outlet (Rivers inlet)	Lyall and Wand	Sept. 27, 1912	30	103		40	Floats, over 60-ft. course. Water low.
V.I.	Sarita river—below the falls	F. W. Knewstubb	Feb 26, 1913	74	118		173	
	do. do.	do.	June, "				233	
	do. do.	do.	Oct. 21, "	74	138	90·09	222	
T	*Scotch creek (Shuswap lake)—near mouth	E. M. Dann	June 8, 1913				2,422	
	do. 3m. from mouth	K. G. Chisholm	Mar. 4, 1915	72	240	2·60	1,140	
	do. do.	do.	April 23, "	72	229	2·33	1,000	
	do. do.	E. M. Dann	June 4, "	83	217	2·28	860	
	do. do.	Archibald and Mason	July 16, "	83	264	2·80	1,200	
	do. do.	Tredcroft and Cline	Oct. 6, "	71	92	0·45	110	
P.C.	Skowquilts river (Dean channel)—½m. from mouth	Macdonald and Wand	Oct. 10, 1912	228	407		970	Water surface 9·3 ft. below B.M. on 16-inch spruce on R. bank 200 yds. below S.E. corner T.L. 31673.
T	*Seymour river (Shuswap lake)—near mouth	E. M. Dann	June 5, 1913				4,272	
P.C.	Seymour river (Seymour inlet)—2m. from mouth	W. A. Wand	Sept. 24, 1912	110	338		555	
K	Sheep creek (near Canalflats)—at highway bridge, 7m above mouth.	G. H. Ferguson	Oct. 10, 1911	40	45		80	Water surface 6·7 ft. below B.M. on north abutment.
T	*Shuswap river—near Couteau falls	Dann and Chisholm	Oct. 30, 1913				1,087	
P.C.	Sim creek (Knight inlet)—200 ft. above rapids	Macdonald and Lyall	Sept. 12, 1912	75	100		1,110	Float measurement in two sections.
C	*Similkameen river—below confluence of Pasayten	J. C. Dufresne	Aug. 29, 1913	70	80		230	Low summer flow estimated.
	do. 4m. above Hedley	do.	Aug 20, "	140	210		632	Meter.
	do. do.	W. Knowles	Mid-winter				270	Low winter flow.
	do. just above Susap creek	J. C. Dufresne	Oct. 14, 1911	165	178		533	Meter.
C	*Sinclair creek (tr. Windermere lake)—at highway bridge, 2m above mouth.	G. H. Ferguson	Oct. 7, 1911	15	15		52	
C	16-mile creek (tr. Similkameen)—at mouth of cañon	J. C. Dufresne	Aug. 20, 1913	4	2·8		5	Floats.
C	*Skagit river—above junction with Skaist	do.	Aug. 26, 1913	10	9		26	Low summer flow. Floats.
	do. below junction with Skaist	do.	Aug 26, "	16	15		44	do.
	do near Int. Boundary	do.	Aug 26, "	60	90		210	do.
C	Skaist river—1m. above mouth		July 14, 1914				1,240	
P.C	*Skeena river—at ferry at Terrace	J. C. Dufresne	Aug 26, 1913	12	12		21	Low summer flow. Floats
K	*Slocan river—at Crescent Valley	G. H. Ferguson	Oct. 13, 1913	775	6,776		36,169	
	do. do.	Biker and Lawley	June 4, 1913	220	2,713	13·7	17,816	
	do do	do.	June 20, "	220	2,404	12·3	12,635	
		do.	July 8, "	220	1,854	9·8	8,294	

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	Sq. feet	Feet	Sec.-feet	
	*Slocan river—at Crescent valley	Biker and Lawley	July 28, 1913	216	1,240	7·0	4,744	
	do. do.	do.	Aug. 8, "	211	1,042	6·2	3,767	
	do. do.	do.	Sept. 8, "	208	893	5·5	2,925	
C	Smith creek (tr. 'big bend' Columbia)—3½m. above mouth	F. W. Knewstubb	Nov 10, 1912	45	35		73	Metered. Fairly low
C	Soard creek (tr. 'big bend' Columbia)—at mouth	F. W. Knewstubb	Oct 26, 1912	42	59		103	Metered. Fairly low.
V.I.	Somas river—combined discharges of Ash, Sproat and Stamp.	F. W. Knewstubb	Feb., 1913				3,400	
F	*Soo river (tr. Green river)—near mouth	Keys and Hughes	May 30, 1914	107	320	2·93	853	
	do. do.	H. C. Hughes	July 19, "	115	426	3·87	1,880	
	do. do.	do.	Aug. 13, "	110	366	3·50	1,320	
	do. do.	Dobbie and Hughes	Dec. 3, "	90	223	1·10	357	Channel probably changed by freshet.
	do. do.	C. E. Dobbie	Jan. 26, 1915	79	355	1·30	61	Ice cover.
	do. do.	Dobbie and Hughes	Feb. 4, "	74	100	0·35	72	
	do. do.	C. E. Dobbie	Mar. 20, "	85	230	1·18	425	
	do. do.	do.	Mar. 24, "	99	267	1·60	658	
	do. do.	do.	April 5, "	108	306	1·75	897	
	do. do.	Cline and Dobbie	April 3, "	102	254	3·00	496	Subsidiary gauge.
	do. do.	C. G. Cline	May 25, "	100	253	3·60	803	do.
P.C.	Southgate river (Bute inlet)—near mouth	Macdonald and Wand	Aug. 28, 1912	225	990		4,370	Floats.
T	*South Thompson river—at Kamloops		May 30, 1911	500	9,700		21,900	
	do. do.		May 30, "	500	9,600		21,100	
P.C.	Stafford river (Loughborough inlet) 800 ft. from mouth	Westover and Lyall	Sept 5, 1912	220	680		660	River low. Water surface 6 ft. below B.M. copper tack on 40-inch spruce on N. side of little creek.
V.I.	*Stamp river—300 ft. below Great Central lake	C. W. Roberts	Mar. 11, 1912	135	480		465	
F	*Stein creek—near mouth	C. E. Richardson	Sept. 22, 1911	57	203	0·60	684	
	do. do.	C. G. Cline	Mar. 27, 1912	38	121	−1·00	152	
	do. do.	do.	May 30, "	55	279	1·75	1,360	
	do. do.	do.	July 26, "	50	250	1·70	1,190	
F	Stellako (outlet François lake)—below cascade	C. J. Vick	Sept. 8, 1912				250	Lake was low. Discharge varies with direction of wind on François lake.
F	Stony creek (tr. lower Nechako)—outlet of Nulki and Tachick lakes	A. W. Campbell	Sept. 17, 1912				5 to 10	
F	Stuart river (tr. lower Nechako)—at mouth	G. H. Ferguson	Sept. 4, 1912				2,000	Discharge estimated.
C	Susap creek (tr. Similkameen)—at mouth of cañon	J. C. Dufresne	Oct. 16, 1911	12	6		9·5	Metered at low water
F	Tachintelachuck creek—outlet of Bednesti lake	A. W. Campbell	Sept. 10, 1912				6	
P.C.	Taleomay river (S. Bentinck Arm)—near mouth	C. C. Lyall	Oct. 5, 1912				800	Medium stage, estimated.
P.C.	Telkwa river (tr. Bulkley)—at Telkwa highway bridge	A. J. McPherson	Sept 11, 1913	50	260		835	
P.C.	Theodosia creek Melaspina inlet)—main stream, 2½m. from mouth, 100 yds. above forks.	C. C. Lyall	Aug. 17, 1912	27	268		253	Metered from tree felled across stream. Water surface 4·9 ft. below B.M. on top of large boulder.
	do. East branch, 300 yds. above forks	do.	Aug. 17, "	18	60		98	Floats, between two logs 30 ft. apart.
P.C.	Toba river—gauged at Indian village	do.	Aug. 22, "	900	4,828		17,843	Water surface 2·5 ft. below B.M. on red cedar on S. bank.
C	*Toby creek (tr. upper Columbia)—at highway bridge 1m. above mouth.	G. H. Ferguson	Sept. 16, 1911	175	365		577	Water surface 8·4 ft. below B.M. in lower sill on the upstream side of east end of bridge
C	Trout creek (tr. Okanagan)—near mouth	J. C. Dufresne	Sept. 6, 1913	8	0·7		1	
V.I.	Tsable river—at upstream side of waggon bridge	F. W. Knewstubb	Mar. 5, 1913	42	49	15·37	82	Float measurement.
F	Tsinkut river (tr. lower Nechako)—in vicinity of lot 21 on Fort George rd.	A. W. Campbell	Sept. 14, 1912	20	24·5		17	

* See footnote, page 452.

MISCELLANEOUS DISCHARGE MEASUREMENTS—*Continued*

District	Stream and location of measuring section	Hydrographer	Date	Width	Area of section	Gauge height	Discharge	Remarks
				Feet	*Sq. feet*	*Feet*	*Sec.-feet*	
P.C.	27-mile creek (tr. Bulkley)—at Moricetown	G. H. Ferguson	Sept. 9, 1913	22	18·6	....	68	Floats, over 40-ft. course.
P.C	22-mile creek (tr Southgate)—near mouth	Macdonald and Wand	Aug. 30, 1912	45	68		416	Floats. Water surface 6 ft. below B.M. on 18-inch spruce on Right bank, 100 ft. from mouth.
P.C.	Two-bridge creek (tr. Bulkley)	G. H. Ferguson	Oct. 2, 1913	30	39		116	
P.C.	Two-mile creek (tr Bulkley)—½m. above mouth	Corbould and Bird	Aug. 29, 1913	9·5	5·4		7·5	
K	Van creek (tr. Bull)— at mouth	G. H Ferguson	Sept. 8, 1911	12	23·4		23·8	
V.I.	View creek—at mouth	F. W. Knewstubb	Oct., 1913	21·5	20·4	2·00	15·6	
	do at outlet lake	do.	Nov 3, "	13·2	17·9	1·00	9·4	
P.C.	Wakeman river (Kingcome inlet)—3m. from mouth in two sections.	Westover and Lyall	Sept. 18, 1912	125	436	......	1,545	Floats. Water surface 10·2 ft. below B.M. on 12-inch cottonwood near island.
P.C.	Wakash creek (Knight inlet)—about 3m. from mouth	Macdonald and Lyall	Sept 12, 1912	39	113		432	Float measurement.
P.C.	Warner Lake outlet (Seymour inlet)—70 ft. above falls	W. A. Wand	Sept 24, 1912	33	46		63	Float measurement.
K	White river (above Canalflats)—1m. above mouth	G. H. Ferguson	Sept. 27, 1911	100	177	..	535	Water surface 10·6 ft. below B.M., established on balsam tree on S. bank.
K	Wild Horse creek—near mouth	W. N. Leete	Mar, 1911	.	....		22	Low water.
	do. do.	D. C. Jennings	Oct 31, "				45	Float measurement.
F	Willow river (tr. upper Fraser)—on lot 2771	A. W. Campbell	Aug. 28, 1912	100	117	......	345	Value of discharge probably low on account of loss by seepage.
K	Wilson creek (tr. Slocan)—near Rosebery		April 18, 1914	....	......	1·85	822	
	do.		May 14, "	....	......	3·48	2,290	
	do.		June 15, "	....	......	3·80	3,320	
	do.		June 18, "	....	....	4·00	2,480	
	do.		July 8, "	....	......	3·50	2,340	
	do.		Aug. 17, "	....	......	0·85	642	
	do.		Nov. 3, "			0·90	759	
V.I.	Wolf creek (Strathcona park)—at mouth	J. Moncton Case	Oct. 8, 1913	55	82	.....	102	Floats.
C	Wood river (tr. 'big bend' Columbia)—½m. below foot of cañon 3m. from mouth.	F. W. Knewstubb	Oct. 12, 1912	90	132	.....	440	Metered. Fairly low.
C	Yellow creek (tr. 'big bend' Columbia)—7m. from mouth at foot of high fall.	do.	Oct. 8, 1912	14·6	9·4	......	14·5	Metered. Fairly low.
P.C.	Zymoets (Copper) river (tr. Skeena)—at Copper city	G. H. Ferguson	Oct. 17, 1913	207	973	......	3,396	B.M. on top of floor sill, 15 ft. above water.

* See footnote, page 452,

CHAPTER XVI

Stream Flow Data

Records by the United States Geological Survey—Water Resources Branch

STREAM flow data for the United States are collected chiefly by the Water Resources Branch of the U. S. Geological Survey. The work was begun in 1888 in connection with special studies relating to irrigation in the arid west, and, since June 30, 1895, appropriations have been made by the United States Congress "For gauging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources." In the execution of the work many state and private organizations have co-operated.

The Water Resources Branch has been the leader in the systematic gathering of stream flow data, and its able engineers have been pioneers in devising and improving methods incident to this work. Much credit is due this organization for its painstaking research and development of the methods now so generally employed in connection with hydrological investigations. The publications of the Branch, as well as the special publications of its Chief Engineer, Mr. N. C. Grover, and Chief Hydrographer, Mr. W. G. Hoyt, have been of very great assistance, not only to the United States, but also to other countries.

Measurements of stream flow have been made at about 3,800 points in the United States, and also at points in Alaska and in the Hawaiian Islands. About 1,500 regular gauging stations are maintained by the Geological Survey and the co-operating organizations. In connection with this work, data respecting precipitation, evaporation, storage reservoirs, river profiles and water-power in many sections of the country have been collected and the results published in the *Water Supply Papers*.

The custom of the Water Resources Branch has been to publish yearly reports. Prior to 1901, gauge heights and discharge measurements were published in *Water Supply Papers* or bulletins, and the estimates of monthly discharge were given in the *Annual Reports of the Geological Survey;* since 1901, both classes of data have been published in the *Water Supply Papers*. In the annual publications, until the last few years, the various data were collated in 12 parts, each embracing an area whose boundaries coincide with the larger natural drainage basins of the country. Lately it has been found

necessary to sub-divide part XII—dealing with the North Pacific drainage basins—into three sections, XII-A, XII-B and XII-C. The district adjacent to British Columbia is known as the 'Pacific Slope in Washington and Upper Columbia River.' The following is a list of published *Water Supply Papers* containing data relating to this and other districts adjacent to British Columbia:*

Year	Washington and Upper Columbia river	Snake river	Lower Columbia river and Oregon
1899	38	38	38
1900	51	51	51
1901	66, 75	66, 75	66, 75
1902	85	85	85
1903	100	100	100
1904	135	135	135
1905	178	178	177†, 178
1906	214	214	214
1907-8	252	252	252
1909	272	272	272
1910	292	292	292
1911	312	312	312
1912	332A	332B	332C
1913	362A	362B	362C
1914	392	393	394
1915	412	413	414

Through the courtesy of Dr. George Otis Smith, Director, United States Geological Survey, the revised hydrometric data to the end of 1915, relating to the more important streams draining areas adjacent to British Columbia, and which are, therefore, international in character, have been made available for publication in this Report.

These data include results from the field operations of the respective District Engineers—of the State of Washington, Mr. G. L. Parker; of Idaho, Mr. G. C. Baldwin; of Montana, Mr. W. A. Lamb; and of Oregon, Mr. F. C. Henshaw—to whom, with the officers before mentioned, the Commission of Conservation is much indebted for the data supplied, as well as for the many courtesies received from this Department of the United States Federal Government.

A list of the stations for which records are here published, together with an Index to the Water Supply Papers where more detailed records respecting gauge heights and daily discharges, etc., may be found, follows. This Index corresponds to the Index for British Columbia stations. The United States records are arranged in a manner similar to the records for British Columbia.

*The recent *Water Supply Papers* contain an annotated list of publications of the U. S. Geological Survey relating specifically to the section of the country dealt with in the respective papers. They also contain a list of reports by the Survey, covering a wide range of hydrological subjects of more general interest, and also give brief references to reports published by State and other organizations. See, for example, *Water Supply Paper No 412*, pp. I-XL. Consult also Wood, B. D., 'Stream-gauging Stations and Publications Relating to Water Resources, 1885-1913,' U. S. Geological Survey, *Water Supply Paper No. 340*, Part XII.

† Rogue, Umpqua, and Siletz rivers only.

LIST OF STREAMS CROSSING THE INTERNATIONAL BOUNDARY OR IN TH
UNITED STATES ADJACENT TO BRITISH COLUMBIA, FOR WHICH STREAM FLO
DATA ARE HERE PRESENTED, WITH INDEX TO WATER SUPPLY PAPERS

No.	Name of stream and location of gauging station	Drainage area	Records available Limiting dates	*Water Supply Papers*						
				1909 272	1910 292	1911 312	1912 332A	1913 362A	1914 392	191 41
U.S.		*Sq. miles*		*page*	*page*	*page*	*page*	*page*	*page*	*pa*
1	Cascade river, near Marblemount..	222*	Mar. 1909–April 1913*a*	487	627	670	....	37	....	....
2	Pend-d'Oreille,‡ at Metaline Falls...	25,600*	Oct. 1912–Dec. 1915	75*b*	68*b*	....	....	57	53	11
3	at Plains..........	19,900*	Oct. 1910–Dec. 1915	....	65	61	61	55	50	10
4	Columbia river, at The Dalles......	237,000*	June 1878–Dec. 1915	69*c*	60*c*	50	*d*	*e*	*f*	*g*
5	Flathead, North fork, at Columbia Falls..	1,620*	Sept. 1910–Dec. 1915	....	78	75	76	69	62	119
6	Kettle river, at Boyd..........	4,060*	Sept. 1913–Oct. 1915*a*	....	....	....	....	....	102	160
7	Kootenay river, at Libby..........	11,000*	Oct. 1910–Dec. 1915	....	118	52	52	47	44	101
8	Moyie river, at Snyder	711*	Mar. 1911–Dec. 1915	....	....	57	57	52	47	104
9	Skagit river, at Marblemount....	1,165†	Dec. 1908–May 1914*a*	485	620	666	37	33	33	....
10	at Reflector Bar....	1,095†	Dec. 1913–Dec. 1915	....	....	....	....	....	31	89

Note—Numbers in first column refer to summary records which follow.

U.S. 1—CASCADE RIVER—near Marblemount, Wash. Drainage area, 222 square miles*

DESCRIPTION OF GAUGING STATION

Location—At a proposed site for a dam and power plant, 8 miles above the mouth and 8 miles above Marblemount.

Records available—March 8, 1909, to April 30, 1913. Station discontinued.

Gauge—Vertical staff on the right bank. Prior to May 25, 1909, two gauges were used, the first from March 8 to 31, 1909, being located 500 feet below the present gauge ; and the second from April 1 to May 24, 1909, being located about 6 miles below the present gauge and set to read the same. No bench mark established.

Channel—Gravel and cobblestones ; shifting in extreme floods.

Discharge measurements—Made from a cable 100 feet below the gauge.

Accuracy—Results good.

Co-operation—Gauge height record and part of the discharge measurements furnished by the Skagit Power Co.

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* As estimated by the United States Geological Survey.

† Revised value based on recent measurements.

‡ In United States, known as the Clark fork.

a Station discontinued.

b Data for 1909 and 1910 at this station are not now considered reliable.

c See also *Water Supply Paper, No. 370*, 'Surface Water Supply of Oregon, 1878-1910,' which gives revised data for the Columbia river at The Dalles, including daily gauge heights and discharges, to Sept. 30, 1910.

d See *Water Supply Paper*, No. 332c, p. 18. *e* No. 362c, p. 18. *f* No. 394. *g* No. 414.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1909				1909			
Mar 8	Jesse E. Rossell	1·00[1]	344	Sept. 5	Jesse E. Rossell	2·53	1,180
April 22	do.	1·40[1]	500	" 12	do.	1·70	582
" 22	do.	1·40[2]	579	" 23	do.	1·80	667
May 6	do.	2·10[2]	1,010	Oct. 12	do.	2·02	823
" 21	do.	1·97[2]	960	Nov. 10	do.	1·80	666
June 3	do.	4·10[3]	2,780	1910			
" 19	do.	3·50	2,520	Dec. 31	Freeman and Gilkey	1·87	556
" 22	J. C. Stevens	2·93	1,510	1911			
July 15	Jesse E. Rossell	3·30	2,000	Mar. 6	H. P. Gilkey	0·80	197
" 19	do.	2·50	1,200	" 16	Ebert and Gilkey	1·05	275
" 21	do.	2·65	1,370	Nov. 8	W. W. Clifford	1·47	382
" 28	do.	2·57	1,330	1912			
Aug. 12	do.	2·38	986	June 5	H. C. Hanson	3·69	1,820
" 20	do.	2·25	906	Oct. 24	F. B. Storey	1·14	297
" 25	do	2·40	1,030				

[1] Gauge No. 1. [2] Gauge No. 2. [3] Gauge heights to measurements beginning June 3, 1909, refer to gauge No. 3.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1908					
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Period	......	......	......	......	......
1910					
Jan.	1,800	284	498	2·24	2·58
Feb.	520	284	355	1·60	1·67
Mar.	1,900	400	976	4·40	5·07
April	4,350	488	1,270	5·72	6·38
May	7,000	640	1,860	8·38	9·66
June	6,060	404	1,220	5·50	6·14
July	4,460	1,400	2,250	10·1	11·64
Aug.	1,630	492	1,010	4·55	5·25
Sept.	1,280	418	674	3·04	3·39
Oct.	8,700	670	2,560	11·5	13·26
Nov.	10,800	700	2,270	10·2	11·38
Dec.	1,440	580	816	3·68	4·24
Year	10,800	284	1,320	5·95	80·66
1912					
Jan.	1,490	250	500	2·25	2·59
Feb.	1,290	305	705	3·18	3·43
Mar.	335	225	274	1·23	1·42
April	585	335	393	1·77	1·98
May	4,250	445	2,050	9·23	10·64
June	6,380	1,490	3,760	16·9	18·86
July	3,450	1,020	2,120	9·55	11·01
Aug.	2,880	445	1,370	6·17	7·11
Sept.	780	275	473	2·13	2·38
Oct.	780	250	324	1·46	1·68
Nov.	1,970	275	626	2·82	3·15
Dec.	535	305	350	1·58	1·82
Year	6,380	225	1,080	4·86	66·07

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1909					
Mar.[1]	1,080	344	421	1·90	1·69
April	678	455	543	2·45	2·73
May	2,660	535	1,180	5·32	6·13
June	6,310	1,440	2,320	10·5	11·71
July	3,370	1,160	1,800	8·11	9·35
Aug.	2,430	694	983	4·43	5·11
Sept.	1,240	494	835	3·77	4·21
Oct.	1,320	472	647	2·91	3·36
Nov.	31,700	444	3,530	15·9	17·74
Dec.	4,000	436	1,109	4·95	5·71
Period	31,700	344	1,352	6·10	67·74
1911					
Jan.	780	344	446	2·01	2·32
Feb.	350	250	275	1·24	1·29
Mar.	900	212	376	1·69	1·95
April	1,240	323	516	2·32	2·59
May	4,960	731	1,350	6·08	7·01
June	7,500	1,190	3,130	14·1	15·73
July	4,250	1,340	2,380	10·7	12·34
Aug	1,720	678	1,080	4·86	5·60
Sept.	1,840	290	848	3·82	4·26
Oct.	710	212	312	1·41	1·63
Nov.	3,160	225	729	3·28	3·66
Dec.	678	290	423	1·91	2·20
Year	7,500	212	991	4·46	60·58
1913					
Jan.	350	228	278	1·25	1·44
Feb.	1,100	222	382	1·72	1·79
Mar.	405	275	326	1·47	1·70
April	2,490	281	738	3·32	3·70
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.	......	......	......	......	......
Nov.	......	......	......	......	......
Dec.	......	......	......	......	......
Year	......	......	......	......	......

[1] For period Mar. 8 to 31.

Note—Accuracy is A, except for following months, when it is B, namely, April to July and Nov. and Dec., 1909, and May and June, 1910. Daily discharges were determined from rating curves used as follows: Mar. 8 to May 24, 1909, fairly well defined; May 25 to Dec. 31, 1909, fairly well defined between 550 and 3,000 second-feet; Jan. 1 to Dec. 31, 1910, fairly well defined between 200 and 3,000 second-feet; Jan. 1, 1911, to April 30, 1913 fairly well defined below 3,000 second-feet.

U.S. 2—PEND-D'OREILLE RIVER—at Metaline Falls, Wash.

Drainage area 25,600 square miles*

DESCRIPTION OF GAUGING STATION

Location—Just above Metaline Falls.

Records available—Oct. 1, 1912, to Dec. 31, 1915.

Gauge—Staff in five sections, one inclined, the others vertical.†

Channel and control—Control is formed by the crest of Metaline falls. Changes in control may be caused by a rock slide on the left side of the river at the falls.

Discharge measurements—Made from a small ferry boat above the gauge, or from a boat held in position by a wire stretched across the river. The measurement of Feb. 11, 1914, was made from the ice cover 2,000 feet above the gauge.

Winter flow—Not seriously affected by ice.

Accuracy—Results good.

DISCHARGE MEASUREMENTS[1]

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1914				1915			
Feb. 11	J. E. Stewart	5·80[2]	10,200	June 19	C. O. Brown	19·35	42,600
June 11	Parker and Brown	28·17[3]	68,100	" 21	Brown and Kornfeldt	19·29	42,700
Dec. 4	Brown and Bailey	10·59	21,000	Sept. 10	Parker and Richardson	7·67	13,900
" 4	do.	10·58	20,600	" 10	do.	7·65	13,700
1915				" 11	Lacy and Parker	7·68	13,900
Mar. 11	C. O. Brown	5·30[4]	9,730				

[1] Discharge of Sullivan creek has been added to measured discharge to obtain total flow past gauge.
[2] Measured from ice cover 2,000 feet above gauge. [3] Measured from boat 1,500 feet above gauge. [4] Measured from boat ¼ mile above gauge.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1912					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.	....	....	....	....	....
Oct.	19,000	15,700	17,600	0·688	0·79
Nov.	20,400	15,700	17,900	0·700	0·78
Dec.[1]	17,900	....	16,100	0·629	0·63
Period	....	....	....	....	....

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1913					
Jan.[2]	....	....	11,100	0·434	0·26
Feb.	13,900	7,720	11,100	0·434	0·45
Mar.	13,900	11,700	12,800	0·500	0·58
April	46,200	13,500	26,500	1·04	1·16
May	79,400	46,500	57,900	2·26	2·61
June	111,000	82,900	102,000	3·98	4·43
July	91,300	43,200	66,100	2·58	2·97
Aug.	42,100	21,300	29,500	1·15	1·32
Sept.	21,100	13,200	16,300	0·627	0·70
Oct.	13,000	11,700	12,100	0·473	0·54
Nov.	14,600	11,900	13,300	0·520	0·58
Dec.	14,600	9,670	12,100	0·473	0·54
Period[3]	111,000	7,720	31,840	1·[illegible]44	15·14

[1] For period Dec. 1-27. [2] Jan. 16-31. [3] For period Jan. 16 to Dec. 31.

Note—Discharges are determined from a rating curve which is well defined between 9,000 and 80,000 second-feet.

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* As estimated by United States Geological Survey.

† A gauge was installed at Metaline Falls in November, 1908. The station was first visited by Survey hydrographers in December, 1912. Prior to this date the two gauges had been knocked out and replaced, in turn, by another gauge. The third gauge consisted of a piece of the old gauge driven into the sand and was not very stable. In April, 1913, the third gauge was replaced by a fourth. The middle section of this gauge was carried out by the next high water, and readings between 27 feet and 13 feet on the falling stage in July and August, 1913, were made on temporary gauges. In December, as the observer could not read the fourth gauge, he installed a temporary gauge Dec. 14, 1913, and read it until Feb. 10, 1914. Feb. 12, 1914, a new permanent gauge was installed. Gauge readings prior to Oct. 1, 1912, are considered entirely unreliable. A good rating curve has been developed for the Metaline Falls gauge and estimates subsequent to Oct. 1, 1912, are considered reliable.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1914						1915					
Jan.....	12,800	10,200	12,100	0·473	0·54	Jan...	13,700	8,760	11,300	0·441	0·51
Feb.....	11,900	6,890	10,300	0·402	0·42	Feb....	10,200	9,330	9,680	0·378	0·39
Mar.....	18,400	11,900	15,000	0·586	0·67	Mar...	13,500	9,[illegible]00	10,900	0·426	0·49
April....	39,900	18,600	27,900	1·09	1·22	April..	30,800	13,900	20,800	0·812	0·91
May....	69,800	40,400	55,600	2·17	2·50	May...	44,000	31,300	37,200	1·45	1·67
June....	70,100	54,300	64,200	2·51	2·80	June...	44,000	40,700	42,700	1·67	1·86
July	54,000	27,000	39,900	1·56	1·80	July...	40,400	30,300	35,700	1·39	1·60
Aug.....	26,500	12,800	18,300	0·715	0·82	Aug...	29,900	16,700	23,200	0·906	1·04
Sept....	12,800	10,400	11,100	0·434	0·48	Sept....	16,300	12,200	13,400	0·523	0·58
Oct.....	18,400	10,800	12,500	0·488	0·56	Oct....	12,200	11,600	11,800	0·461	0·53
Nov.....	21,800	15,400	19,700	0·770	0·86	Nov...	12,600	11,300	11,800	0·461	0·51
Dec.....	21,300	12,400	16,300	0·637	0·73	Dec...	12,600	11,600	12,100	0·473	0·55
Year....	70,100	6,890	25,240	0·987	13·40	Year...	44,000	8,760	20,050	0·783	10·64

U.S. 3—PEND-D'OREILLE RIVER—near Plains, Mont. Drainage area, 19,900 square miles *

DESCRIPTION OF GAUGING STATION

Location—At Cooper's ferry, about 3 miles above Plains, Mont., and about 7 miles below the mouth of Flathead river.

Records available—Oct. 28, 1910, to Dec. 31, 1915.

Gauge—Overhanging chain gauge on the right bank, about 150 feet below the ferry cable. On Nov. 28, 1911, a Barrett & Lawrence automatic gauge was installed 50 feet below the chain gauge and set to read the same.

Bench mark—Nail in root of pine tree 35 feet northeast of gauge. Elevation 16·38 feet above gauge zero.

Channel—Fairly permanent.

Discharge measurements—Made from the ferry cable or from the highway bridge at Plains.

Winter flow—Stream freezes over at the gauge for short periods, but is open at the control section below the gauge. Relation between gauge height and discharge little, if at all, affected by ice.

Diversions—A number of small ditches divert for irrigation from tributaries of Flathead river and headwaters of Pend-d'Oreille.

Accuracy—Rating curve good, but gauge height record somewhat doubtful at times.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1910				1912			
Nov. 10	Raymond Richards.....	5·51	10,300	June 1	J. C. Beebe............	13·38	72,700 [1]
1911				1913			
May 1	W. A. Lamb...........	8·75	29,000	May 28	W. A. Lamb...........	15·30	92,800 [2]
July 9	B. F. Jones............	10·86	46,500	July 29	B. E. Jones............	8·00	23,400
" 18	J. C. Beebe...........	9·09	31,700	Dec. 9	W. A. Lamb	4·51	8,160
" 26	F. E. Bonner...........	7·87	26,900	1914			
Aug. 7	W. A. Lamb...........	6·87	17,800	May 8	do.	9·55	38,000
Nov. 28	do	4·36	7,090	Sept. 18	do.	4·58	8,720

[1] Surface velocities observed and coefficient of 0·86 used.
[2] Surface velocities observed and coefficient of 0·85 used.

* As estimated by the United States Geological Survey. An estimate based on recent measurements, using the latest available maps for portion of watershed in British Columbia, gives 20,000 square miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1910					
Jan.	......	......	......	......	......
Feb.	......	......	......	......	......
Mar.	......	......	......	......	......
April	......	......	......	......	......
May	......	......	......	......	......
June	......	......	......	......	......
July	......	......	......	......	......
Aug.	......	......	......	......	......
Sept.	......	......	......	......	......
Oct.[1]	9,760	9,400	9,490	0·477	0·07
Nov.	14,700	9,400	12,400	0·623	0·70
Dec.	13,100	[illegible]	10,500	0·528	0·61
Period	......				
1912					
Jan.[6]			5,500	0·276	0·23
Feb.[7]	6,470	5,620	5,970	0·300	0·19
Mar.	8,100	5,290	5,800	0·294	0·34
April	22,700	7,540	15,500	0·779	0·87
May	73,600	23,300	49,300	2·48	2·86
June	74,500	50,100	65,200	3·28	3·66
July	51,000	19,200	32,400	1·63	1·88
Aug.	18,600	9,760	13,100	0·658	0·76
Sept.	10,900	9,400	10,100	0·508	0·57
Oct.	9,400	8,400	8,840	0·444	0·51
Nov.	9,760	8,400	9,040	0·454	0·51
Dec.	......	......	......	......	......
Period	74,500	5,290	...	...	12·38
1914					
Jan.	7,600	6,620	7,410	0·372	0·43
Feb.	8,720	5,970	7,360	0·370	0·38
Mar.	10,700	7,600	8,590	0·432	0·50
April	27,800	8,420	16,900	0·849	0·95
May[10]	67,000	27,100	48,900	2·46	2·84
June	62,300	36,700	49,200	2·47	2·76
July	35,100	14,600	23,800	1·20	1·38
Aug.	14,100	8,720	10,600	0·533	0·61
Sept.[11]	8,720	8,420	8,480	0·426	0·48
Oct.[12]	11,900	8,130	9,830	0·494	0·57
Nov.	16,600	11,100	14,200	0·713	0·79
Dec.[13]	11,900	7,860	9,510	0·478	0·55
Year	67,000	5,970	17,900	0·900	12·24

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Jan.	8,720	6,970	8,010	0·403	0·46
Feb.	6,970	6,020	6,440	0·324	0·34
Mar.	10,900	6,240	8,070	0·406	0·47
April[2]	11,700	10,900	[illegible]	0·563	0·17
May[3]	36,600	28,200	31,900	1·60	0·36
June	......	......	......	......	......
July[4]	46,600	18,000	30,600	1·54	1·32
Aug.	19,700	9,400	14,400	0·724	0·83
Sept.	19,100	8,720	9,570	0·481	0·54
Oct.	10,500	8,100	9,520	0·478	0·55
Nov.	8,400	6,470	7,770	0·390	0·44
Dec.[5]	8,400	6,240	7,090	0·356	[illegible]
Period	......	6,020			......
1913					
Jan.	8,400	6,240	7,360	0·370	0·43
Feb.[8]	......	6,470	7,940	0·399	0·41
Mar.	7,810	6,240	7,030	0·353	0·41
April	34,200	7,810	18,800	0·954	1·05
May	106,000	29,700	53,900	2·71	3·12
June	115,000	71,500	98,200	4·93	5·49
July	69,200	23,800	42,800	2·15	2·48
Aug.	23,100	12,300	17,000	0·855	0·98
Sept.	11,500	9,350	10,100	0·507	0·57
Oct.	9,030	8,720	8,740	0·439	0·51
Nov.[9]	[illegible]	8,720	9,070	0·456	0·51
Dec.	9,030	[illegible]	8,040	0·404	0·46
Year	115,000	6,240	24,080	1·210	16·42
1915					
Jan.	9,100	7,200	7,970	0·400	0·46
Feb.	8,050	7,090	7,350	0·369	0·38
Mar.	7,600	6,850	7,180	0·361	0·41
April	24,400	7,860	15,500	0·778	0·87
May	35,900	26,400	31,200	1·57	1·81
June	37,400	32,800	35,400	1·78	1·99
July	32,800	19,400	26,500	1·33	1·53
Aug.	18,800	10,400	14,400	0·724	0·83
Sept.	10,700	9,350	9,960	0·500	0·56
Oct.	10,400	8,720	9,370	0·470	0·54
Nov.[14]	8,720	8,130	8,560	0·430	0·48
Dec.[15]	9,030	7,700	8,660	0·435	0·50
Year	37,400	6,850	15,170	0·762	10·36

[1] For period Oct. 28 to 31. [2] April 1 to 8. [3] May 1 to 6. [4] July 9 to 31. [5] Dec. 1 to 8. [6] Jan. 1 to 22; gauge heights of doubtful accuracy, mean discharge estimated at 5,?00 second-feet by comparison with other stations. [7] Feb. 13 to 29. [8] Discharge relation believed to have been affected by ice, Feb. 16 to 24, mean discharge estimated at 9,000 second-feet. [9] Nov. 4 to 22 mean discharge estimated at 9,000 second-feet. [10] Gauge heights, May 8 to 18, estimated by comparison with gauge heights of Pend-d'Oreille at Thompson, Mont. [11] Partly estimated. [12] Daily discharge ... 16 to Nov. 30 was estimated from gauge heights at Thompson falls, 25 miles downstream, by the Montana Power Co. [13] Discharge after Dec. 20 was estimated from the flow of Pend-d'Oreille at St. Regis and Flathead river near Polson. [14] Discharges Nov. 11 to Dec. 9 estimated from station at Thompson falls and Flathead river at Polson. [15] Discharges Dec. 20 to 31 estimated by comparison with Pend-d'Oreille at St. Regis and Flathead river.

Note—Daily discharges Oct. 28, 1910, to May 11, 1913, determined from a fairly well defined rating curve. Discharges May 12 to Dec. 21, 1913, determined from a rating curve that is well defined between 30,000 and 80,000 second-feet, and fairly well defined outside those limits. In 1914 and 1915 discharges were determined from a well-defined rating curve.

U.S. 4—COLUMBIA RIVER—at The Dalles, Oregon

Drainage area 237,000 square miles

DESCRIPTION OF GAUGING STATION

Location—At the dock of The Dalles, Portland and Astoria Navigation Co.

Records available—June 1, 1878, to Dec. 31, 1915; maximum stages, 1858 to 1877.*

Gauge—Vertical staff in several sections, attached to piling; datum 45·6 feet above sea level,† known as the 'Brooks' gauge; maintained by U. S. Weather Bureau; read since Feb. 1, 1892. Other gauges have been read as follows: High water periods, 1858 to 1877, gauge of Oregon Steam Navigation Co. at Lower Cascades landing; June 1 to Dec. 6, 1878, U. S. Engineer Corps' gauge, Umatilla, Oreg.; Dec. 12, 1878, to Dec. 31, 1915, when 'Brooks' gauge

(*) Discharge estimates 1879 to 1910 have been re-computed and results here given supersede those published in *Water Supply Papers*, Nos. 252, 272 and 292, of the United States Geological Survey.

(†) Compare *Water Supply Paper* No. 370, page 16.

was not end, U.S. Engineer Corps' gauge above the Cascades ; Oct. 10, 1879, to June 30, 1881, U. S. Engineer Corps' gauge at The Dalles.*

Channel—Wide and deep ; volcanic rock covered with sand and silt ; control is rock reef at the Cascades ; practically permanent.

Discharge measurements—In 1903, made with floats and with current meter at Cayuse rock, 7 miles below The Dalles. In 1907, made with a current meter from a boat at the gauge. In 1908, made with floats at the gauge. In 1910 and 1913, made from the Northern Pacific Ry. bridge just above the mouth of Snake river, the discharges of Snake, Umatilla, John Day and Deschutes rivers at their mouths being determined from gauge readings and added to the measured discharge to give the flow at The Dalles. An allowance of one day was made for the time interval between Snake river and The Dalles.

Rating curves—For discussion respecting rating curves and discharge estimates published in reports of United States Geological Survey, see statements made in *Water Supply Paper No. 370*, p. 17.

Extreme stages—The highest flood of authentic record occurred in June, 1894. It was due to the coincidence of floods in the Columbia and Snake, accompanied by heavy rainfall in the lower drainage area. The snowfall all over the Columbia basin had been exceptionally heavy during the previous winter. The highest stage at Cascade locks was 49·7 feet at 4 p.m., June 6, corresponding to a discharge of 1,160,000 second-feet, or 4·89 second-feet per square mile. There is no authentic record of the flood of 1849, but it may have closely approached this flood in peak discharge. The lowest stage of which there is authentic record occurred in January, 1890, which also gives the lowest monthly mean on record. It was caused by a period of extremely cold weather following the driest year on record. The gauge above the Cascades could not be read on account of ice from Jan. 3 to 16, 1890. A reading was made on the gauge below the locks Jan. 7, and the discharge was determined from a relation of gauge readings to be 41,900 second-feet. Any sudden drop in temperature when the river is low seems to cause a marked dropping off in discharge. It is probable that all the extreme low stages have been caused in this way. In the annual report of the Chief of U. S. Engineers for 1879 it is stated that the low water of Jan. 18, 1879, was the lowest for the preceding ten years, but was 2 to 3 feet higher than the low waters of 1859 and 1862. This would seem to indicate that, in the earliest years of settlement of the country, there were periods during which the stage was as low as the lowest recorded stages, but probably no lower.

Accuracy—The results as now computed are believed to be fair for 1878 to 1884, and excellent for later periods. The area tributary to Columbia river between The Dalles and the Cascades is only about 1 per cent of the area above The Dalles and the discharge from this intermediate area is not much over 3 per cent of the total discharge. Variations in this intermediate inflow probably cause little inaccuracy in the results of studies of relations of gauge heights.

Co-operation—See *Water Supply Paper No. 370*, p. 18, United States Geological Survey.

DISCHARGE MEASUREMENTS

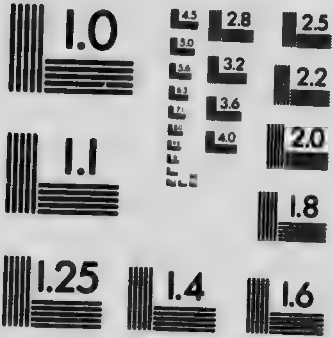
Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1903				1903			
Jan. 20 f	U.S. Engineer Corps.....	2·90	80,700	Feb. 17	U.S. Engineer Corps....	1·80	76,200
" 22	do.	3·50	86,900	" 18 f	do.	1·80	71,100
" 27	do.	9·70	168,000	" 19	do.	1 60	76,400
" 28	do.	10·70	174,000	" 20 f	do.	1·40	72,100
" 30 f	do.	9·00	142,000	" 20	do.	1·40	77,300
" 31 f	do.	7·70	128,000	1907			
Feb. 2 f	do.	6·00	109,000	Oct. 31	J. C. Stevens..........	3·72	95,400
" 3 f	do.	5·30	104,000	1908			
" 5 f	do.	4·30	95,300	June 20 f	H. D. McGlashan......	36·20	630,000
" 6 f	do.	3·70	89,700	July 9 f	McGlashan and Allen ...	27·40	444,000
" 11	do.	3·50	88,700	1910			
" 12 f	do.	3·30	85,100	Nov. 1	See below..............	5·5	115,000
" 13	do.	3·10	83,500	1913			
" 14	do.	2·80	85,500	June 16	do.	41·1	742,000
" 16 f	do.	2·10	74,500	July 17	do.	22·4	356,000
				Nov. 21	do.	4·3	101,000

f Float measurement.

* For statement relating to checks on gauges, see *Water Supply Paper No. 370*, page 17; U. S. Geological Survey.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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DISCHARGES OF THE COLUMBIA RIVER AT THE DALLES, OREGON, COMPUTED FROM MEASUREMENTS AT PASCO, WASHINGTON

Date	Measured discharge Columbia river at Pasco, Wash	Snake river at Burbank, Wash.		Umatilla river at Umatilla, Oreg.		John Day river at McDonald, Oreg.		Deschutes river, at Moody, Oreg.		Columbia river at The Dalles		
		Gauge height	Discharge	Gauge height	Discharge	Gauge height	Discharge	Gauge height	Discharge	Gauge height	Discharge	Date
1910 Oct. 31...	86,500 [1]	36·3	23,000	2·3	49	1·6	260	2·34	5,190	5·5	115,000	1910 Nov. 1
1913 June 15...	537,000	47·2	195,000	2·6	140	3·8	2,880	3·0	7,410	41·1	742,000	1913 June 16
July 16-17	303,000	38·8	46,000	2·6	140	2·35	930	2·6	5,980	22·4	356,000	J'ly 17-18
Nov. 20	61,200	37·7	33,000	2·85	250	2·15	745	2·6	5,980	4·3	101,000	Nov. 21

[1] Measured at Richland ferry, discharge of Yakima river at Richland added.

MAXIMUM GAUGE HEIGHT IN FEET OF COLUMBIA RIVER AT LOWER CASCADES LANDING, AND DISCHARGE IN SECOND-FEET, AT THE DALLES FOR 1858 TO 1877

(Gauge heights observed by Oregon Steam Navigation Co.)

Year	Gauge height	Discharge	Year	Gauge height	Discharge
1858	84·3	563,000	1868	81·8	483,000
1859	93·6	874,000	1869	76·6	328,000
1860	87·5	668,000	1870	90·8	777,000
1861	86·0	618,000	1871	93·1	856,000
1862 [1]	95·7	948,000	1872	89·6	737,000
1863	90·8	777,000	1873	86·6	638,000
1864	87·1	654,000	1874	81·9	582,000
1865	88·9	714,000	1875	88·0	684,000
1866	92·6	839,000	1876 [2]	96·0	958,000
1867	87·6	671,000	1877	81·9	483,000

[1] High-water mark at The Dalles for 1862 was 48·9 feet, discharge 923,000 sec.-feet.

[2] High-water mark at The Dalles for 1876, 52·3 feet, discharge 1,000,000 sec. ft., at Cascades locks 43·4 feet; discharge 948,000 sec.-feet.

Note—Discharge determined from a curve showing the relation between reading of the gauge of the Oregon Steam Navigation Co. at Lower Cascades landing and the gauge of the U. S. Engineer Corps above the Cascades. This relation curve is based on comparative readings made from 1879 to 1884 and is fairly well defined. Asst. Engineer Habershan, in a report made in 1874, states that the flood of 1849 was 5 feet higher above Celilo falls than the flood of 1862. This would indicate a maximum discharge for 1849 nearly as great as the maximum for 1894. Height of the flood of 1849 probably overestimated.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1878						**1879**					
Jan.	......	......	......	......	......	Jan.	71,000	61,200	65,900	0·278	0·32
Feb.	......	......	......	......	......	Feb.	217,000	59,600	87,200	0·368	0·38
Mar.	......	......	......	......	......	Mar.	317,000	130,000	181,000	0·764	0·88
April	......	......	......	......	......	April	453,000	313,000	360,000	1·52	1·70
May	......	......	......	......	......	May	550,000	325,000	395,000	1·67	1·92
June	485,000	370,000	426,000	1·80	2·01	June	643,000	559,000	612,000	2·58	2·88
July	370,000	219,000	273,000	1·15	1·33	July	600,000	381,000	501,000	2·11	2·43
Aug.	222,000	155,000	184,000	0·776	0·89	Aug.	379,000	209,000	275,000	1·16	1·34
Sept.	151,000	93,200	124,000	0·523	0·58	Sept.	204,000	119,000	154,000	0·650	0·73
Oct.	100,000	82,900	89,800	0·379	0·44	Oct.	124,000	91,000	110,000	0·464	0·53
Nov.	93,200	76,200	83,500	0·352	0·39	Nov.	93,000	75,400	85,400	0·360	0·40
Dec.	115,000	71,000	91,000	0·381	0·44	Dec.	99,000	69,000	85,400	0·360	0·42
Period	485,000	71,000	181,600	0·767	6·08	Year	643,000	59,600	242,700	1·023	13·93
1880						**1881**					
Jan.	112,000	81,100	98,400	0·415	0·48	Jan.	195,000	73,800	107,000	0·451	0·52
Feb.	95,000	68,300	77,200	0·326	0·35	Feb.	361,000	77,800	211,000	0·890	0·93
Mar.	97,000	68,300	75,200	0·317	0·37	Mar.	318,000	170,000	221,000	0·932	1·07
April	232,000	87,400	151,000	0·637	0·71	April	495,000	278,000	386,000	1·63	1·82
May	524,000	255,000	404,000	1·70	1·96	May	449,000	405,000	426,000	1·80	2·08
June	914,000	536,000	698,000	2·95	3·29	June	598,000	428,000	546,000	2·30	2·57
July	914,000	629,000	793,000	3·35	3·86	July	556,000	313,000	431,000	1·82	2·10
Aug.	607,000	258,000	386,000	1·63	1·88	Aug.	311,000	181,000	244,000	1·03	1·19
Sept.	254,000	154,000	198,000	0·835	0·93	Sept.	178,000	124,000	141,000	0·595	0·66
Oct.	152,000	113,000	131,000	0·553	0·64	Oct.	130,000	99,100	110,000	0·464	0·53
Nov.	121,000	83,800	104,000	0·439	0·49	Nov.	134,000	91,100	112,000	0·473	0·53
Dec.	93,000	75,400	80,700	0·341	0·39	Dec.	92,200	78,000	86,400	0·365	0·42
Year	914,000	68,300	266,400	1·123	15·35	Year	598,000	73,800	251,800	1·061	14·42

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1882					
Jan.	94,400	60,400	78,400	0·331	0·38
Feb.	92,200	60,400	66,700	0·281	0·29
Mar.	183,000	75,000	95,600	0·403	0·46
April	262,000	192,000	229,000	0·966	1·08
May	542,000	210,000	336,000	1·42	1·64
June	883,000	540,000	770,000	3·25	3·63
July	643,000	321,000	477,000	2·01	2·32
Aug.	313,000	200,000	263,000	1·11	1·28
Sept.	197,000	118,000	150,000	0·633	0·71
Oct.	119,000	102,000	110,000	0·464	0·53
Nov.	113,000	79,000	94,400	0·398	0·44
Dec.	197,000	78,000	121,000	0·511	0·59
Year	883,000	60,400	232,600	0·982	13·35
1884					
Jan.	94,400	38,800	71,900	0·303	0·35
Feb.	163,000	45,800	71,900	0·303	0·33
Mar.	121,000	87,800	105,000	0·443	0·51
April	286,000	117,000	203,000	0·857	0·96
May	607,000	250,000	404,000	1·70	1·96
June	698,000	588,000	648,000	2·73	3·05
July	573,000	298,000	403,000	1·70	1·96
Aug.	300,000	194,000	255,000	1·08	1·24
Sept.	195,000	123,000	166,000	0·700	0·78
Oct.	150,000	112,000	133,000	0·561	0·65
Nov.	159,000	116,000	135,000	0·570	0·64
Dec.	110,000	44,300	80,600	0·340	0·39
Year	698,000	44,300	223,000	0·941	12·82
1886					
Jan.	203,000	64,400	101,000	0·426	0·49
Feb.	217,000	140,000	178,000	0·751	0·78
Mar.	134,000	100,000	122,000	0·515	0·59
April	260,000	129,000	209,000	0·882	0·98
May	597,000	239,000	342,000	1·44	1·66
June	673,000	458,000	577,000	2·43	2·71
July	456,000	266,000	351,000	1·48	1·71
Aug.	262,000	150,000	201,000	0·848	0·98
Sept.	147,000	101,000	125,000	0·527	0·59
Oct.	99,300	76,000	85,900	0·362	0·42
Nov.	78,000	62,800	69,700	0·294	0·33
Dec.	90,400	62,000	75,300	0·318	0·37
Year	673,000	62,000	203,100	0·857	11·61
1888					
Jan.	215,000	49,400	80,200	0·338	0·39
Feb.	190,000	123,000	144,000	0·608	0·66
Mar.	137,000	102,000	120,000	0·506	0·58
April	306,000	128,000	189,000	0·797	0·89
May	412,000	282,000	362,000	1·53	1·76
June	564,000	420,000	515,000	2·17	2·42
July	451,000	262,000	338,000	1·43	1·65
Aug.	256,000	190,000	213,000	0·899	1·04
Sept.	188,000	120,000	153,000	0·640	0·72
Oct.	119,000	89,200	102,000	0·430	0·50
Nov.	109,000	82,300	93,200	0·393	0·44
Dec.	94,100	78,000	85,500	0·361	0·42
Year	564,000	49,400	199,600	0·842	11·47
1890					
Jan.	67,000	41,900	51,400	0·217	0·25
Feb.	197,000	62,000	117,000	0·494	0·51
Mar.	179,000	59,600	120,000	0·506	0·58
April	300,000	145,000	192,000	0·810	0·90
May	633,000	325,000	559,000	2·36	2·72
June	532,000	388,000	437,000	1·84	2·05
July	381,000	248,000	326,000	1·38	1·59
Aug.	246,000	157,000	194,000	0·819	0·94
Sept.	152,000	90,400	121,000	0·511	0·57
Oct.	95,400	83,400	89,100	0·376	0·43
Nov.	84,500	73,000	77,600	0·327	0·36
Dec.	74,000	65,200	69,600	0·294	0·34
Year	633,000	41,900	196,100	0·828	11·24

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1883					
Jan.	148,000	58,800	87,100	0·368	0·42
Feb.	148,000	63,600	87,500	0·369	0·38
Mar.	298,000	121,000	178,000	0·751	0·87
April	283,000	167,000	197,000	0·831	0·93
May	525,000	195,000	404,000	1·70	1·96
June	573,000	494,000	534,000	2·25	2·51
July	542,000	244,000	397,000	1·68	1·94
Aug.	237,000	157,000	202,000	0·852	0·98
Sept.	152,000	103,000	126,000	0·532	0·59
Oct.	100,000	79,000	90,800	0·383	0·44
Nov.	85,600	69,000	74,300	0·313	0·35
Dec.	84,700	64,400	73,500	0·310	0·36
Year	573,000	58,800	204,300	0·862	11·73
1885					
Jan.	123,000	76,000	93,400	0·394	0·45
Feb	190,000	95,400	164,000	0·692	0·72
Mar.	221,000	149,000	189,000	0·797	0·92
April	290,000	215,000	259,000	1·09	1·22
May	434,000	237,000	372,000	1·57	1·81
June	482,000	388,000	445,000	1·88	2·10
July	447,000	237,000	340,000	1·43	1·65
Aug.	233,000	183,000	203,000	0·857	0·99
Sept.	179,000	139,000	155,000	0·654	0·73
Oct.	149,000	96,700	122,000	0·515	0·59
Nov.	115,000	92,800	103,000	0·435	0·49
Dec.	110,000	92,800	103,000	0·435	0·50
Year	482,000	76,000	212,400	0·897	12·17
1887					
Jan.	122,000	86,800	99,100	0·418	0·48
Feb.	106,000	66,100	75,300	0·318	0·33
Mar.	258,000	73,000	176,000	0·743	0·86
April	282,000	235,000	259,000	1·09	1·22
May	720,000	319,000	422,000	1·78	2·05
June	896,000	713,000	809,000	3·41	3·80
July	760,000	403,000	585,000	2·47	2·85
Aug.	393,000	228,000	289,000	1·22	1·41
Sept.	221,000	128,000	171,000	0·722	0·81
Oct.	126,000	99,300	114,000	0·481	0·55
Nov.	117,000	90,400	100,000	0·422	0·47
Dec.	115,000	88,000	99,200	0·419	0·48
Year	896,000	66,100	266,600	1·124	15·31
1889					
Jan.	70,000	62,800	66,400	0·280	0·32
Feb.	64,400	57,400	63,700	0·269	0·28
Mar.	110,000	63,600	88,700	0·374	0·43
April	179,000	110,000	152,000	0·641	0·72
May	294,000	188,000	254,000	1·07	1·23
June	302,000	215,000	268,000	1·13	1·26
July	213,000	167,000	183,000	0·772	0·89
Aug.	172,000	119,000	149,000	0·629	0·73
Sept.	120,000	78,000	96,400	0·407	0·45
Oct.	95,400	79,000	87,500	0·369	0·43
Nov.	88,000	69,000	77,400	0·327	0·86
Dec.	70,000	54,800	64,600	0·273	0·31
Year	302,000	54,800	129,200	0·546	7·41
1891					
Jan.	72,000	60,400	65,900	0·278	0·32
Feb.	71,000	58,800	62,600	0·264	0·27
Mar.	108,000	57,400	73,700	0·311	0·36
April	219,000	88,000	137,000	0·578	0·64
May	441,000	222,000	342,000	1·44	1·66
June	448,000	379,000	420,000	1·77	1·98
July	370,000	254,000	306,000	1·29	1·49
Aug.	250,000	159,000	205,000	0·865	1·00
Sept.	159,000	108,000	132,000	0·557	0·62
Oct.	108,000	80,100	88,300	0·373	0·43
Nov.	132,000	84,500	108,000	0·456	0·51
Dec.	110,000	90,400	99,800	0·421	0·49
Year	448,000	57,400	170,000	0·717	9·77

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1892					
Jan.	95,400	68,000	79,000	0·333	0·38
Feb.	84,700	66,200	73,000	0·308	0·33
Mar.	164,000	84,700	127,000	0·536	0·62
April	177,000	128,000	153,000	0·646	0·72
May	568,000	166,000	298,000	1·26	1·45
June	607,000	481,000	544,000	2·30	2·57
July	583,000	281,000	447,000	1·89	2·18
Aug.	278,000	160,000	210,000	0·886	1·02
Sept.	159,000	131,000	145,000	0·612	0·68
Oct.	131,000	96,000	111,000	0·468	0·54
Nov.	118,000	91,000	98,200	0·414	0·46
Dec.	99,000	69,000	86,000	0·363	0·42
Year	607,000	66,200	197,600	0·834	11·37

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1893					
Jan.	93,000	69,800	77,700	0·328	0·38
Feb.	105,000	61,300	81,900	0·346	0·36
Mar.	115,000	63,400	71,000	0·300	0·35
April	249,000	130,000	170,000	0·717	0·80
May	613,000	252,000	441,000	1·86	2·14
June	679,000	534,000	597,000	2·52	2·81
July	528,000	390,000	465,000	1·96	2·26
Aug.	381,000	185,000	273,000	1·15	1·33
Sept.	181,000	120,000	150,000	0·633	0·71
Oct.	150,000	108,000	122,000	0·515	0·59
Nov.	170,000	107,000	142,000	0·599	0·67
Dec.	218,000	118,000	166,000	0·700	0·81
Year	679,000	61,300	229,700	0·969	13·21

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1894					
Jan.	219,000	102,000	145,000	0·612	0·71
Feb.	142,000	88,300	114,000	0·481	0·50
Mar.	284,000	113,000	163,000	0·688	0·79
April	465,000	266,000	323,000	1·36	1·52
May	1,020,000	395,000	575,000	2·43	2·80
June	1,160,000	739,000	970,000	4·09	4·56
July	716,000	376,000	553,000	2·33	2·69
Aug.	372,000	217,000	271,000	1·14	1·31
Sept.	217,000	137,000	175,000	0·738	0·82
Oct.	139,000	125,000	133,000	0·561	0·65
Nov.	150,000	129,000	136,000	0·574	0·64
Dec.	140,000	88,000	114,000	0·481	0·55
Year	1,160,000	88,000	306,000	1·291	17·54

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1895					
Jan.	131,000	81,200	102,000	0·430	0·50
Feb.	132,000	80,100	94,000	0·397	0·41
Mar.	137,000	105,000	119,000	0·502	0·58
April	276,000	143,000	182,000	0·768	0·86
May	475,000	281,000	376,000	1·59	1·83
June	459,000	342,000	381,000	1·61	1·80
July	392,000	264,000	348,000	1·47	1·70
Aug.	250,000	148,000	206,000	0·869	1·00
Sept.	149,000	108,000	129,000	0·544	0·61
Oct.	105,000	84,500	96,500	0·407	0·47
Nov.	85,600	74,000	78,600	0·332	0·37
Dec.	79,000	70,000	75,300	0·318	0·37
Year	475,000	70,000	182,300	0·769	10·50

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1896					
Jan.	125,000	70,000	90,000	0·381	0·44
Feb.	123,000	81,100	92,600	0·391	0·42
Mar.	212,000	103,000	134,000	0·565	0·65
April	206,000	152,000	180,000	0·760	0·85
May	426,000	205,000	268,000	1·13	1·30
June	785,000	481,000	679,000	2·86	3·19
July	778,000	386,000	639,000	2·70	3·11
Aug.	372,000	191,000	256,000	1·08	1·24
Sept.	191,000	114,000	157,000	0·662	0·74
Oct.	110,000	78,000	89,300	0·377	0·43
Nov.	194,000	78,000	122,000	0·515	0·57
Dec.	212,000	102,000	163,000	0·688	0·79
Year	785,000	70,000	239,200	1·010	13·73

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1897					
Jan.	134,000	98,000	115,000	0·485	0·56
Feb.	155,000	98,000	123,000	0·519	0·54
Mar.	208,000	84,500	109,000	0·460	0·53
April	501,000	130,000	299,000	1·26	1·41
May	780,000	447,000	624,000	2·63	3·03
June	739,000	445,000	540,000	2·28	2·54
July	451,000	263,000	372,000	1·57	1·81
Aug.	255,000	192,000	210,000	0·886	1·02
Sept.	188,000	102,000	137,000	0·578	0·64
Oct.	106,000	85,600	97,100	0·410	0·47
Nov.	165,000	82,000	114,000	0·481	0·54
Dec.	168,000	117,000	141,000	0·595	0·69
Year	780,000	82,000	240,100	1·013	13·78

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1898					
Jan.	155,000	84,700	113,000	0·477	0·55
Feb.	260,000	82,900	147,000	0·620	0·65
Mar.	181,000	113,000	147,000	0·620	0·71
April	337,000	111,000	201,000	0·848	0·95
May	594,000	328,000	420,000	1·77	2·04
June	649,000	547,000	603,000	2·54	2·83
July	541,000	300,000	399,000	1·68	1·94
Aug.	291,000	202,000	237,000	1·00	1·15
Sept.	199,000	116,000	143,000	0·603	0·67
Oct.	114,000	85,600	97,400	0·411	0·47
Nov.	87,400	78,600	83,600	0·353	0·39
Dec.	84,700	58,000	68,500	0·289	0·33
Year	649,000	58,000	221,600	0·935	12·68

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1899					
Jan.	142,000	71,400	98,500	0·416	0·48
Feb.	130,000	80,200	109,000	0·460	0·48
Mar.	126,000	94,000	106,000	0·447	0·52
April	245,000	120,000	192,000	0·810	0·90
May	469,000	201,000	309,000	1·30	1·50
June	787,000	471,000	638,000	2·69	3·00
July	727,000	447,000	614,000	2·59	2·99
Aug.	435,000	232,000	307,000	1·30	1·50
Sept.	230,000	168,000	193,000	0·814	0·91
Oct.	168,000	125,000	140,000	0·591	0·68
Nov.	166,000	112,000	130,000	0·549	0·61
Dec.	194,000	132,000	157,000	0·662	0·76
Year	787,000	71,400	249,500	1·052	14·33

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1900					
Jan.	251,000	138,000	168,000	0·709	0·82
Feb.	142,000	103,000	125,000	0·527	0·55
Mar.	230,000	132,000	187,000	0·789	0·91
April	303,000	216,000	272,000	1·15	1·28
May	536,000	291,000	450,000	1·90	2·19
June	441,000	381,000	411,000	1·73	1·93
July	437,000	239,000	323,000	1·36	1·57
Aug.	239,000	152,000	187,000	0·789	0·91
Sept.	157,000	120,000	136,000	0·574	0·64
Oct.	137,000	99,000	114,000	0·481	0·55
Nov.	142,000	106,000	125,000	0·527	0·59
Dec.	180,000	111,000	138,000	0·582	0·67
Year	536,000	99,000	219,700	0·927	12·61

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1901					
Jan.	160,000	108,000	129,000	0·544	0·63
Feb.	206,000	81,100	122,000	0·515	0·54
Mar.	269,000	152,000	187,000	0·789	0·91
April	211,000	137,000	165,000	0·696	0·78
May	646,000	205,000	429,000	1·81	2·09
June	662,000	405,000	516,000	2·18	2·43
July	412,000	286,000	340,000	1·43	1·65
Aug.	281,000	166,000	219,000	0·924	1·07
Sept.	165,000	99,000	132,000	0·557	0·62
Oct.	101,000	77,000	85,800	0·362	0·42
Nov.	94,000	77,000	83,900	0·354	0·40
Dec.	114,000	77,800	92,500	0·390	0·45
Year	662,000	77,000	208,400	0·880	11·99

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1902					
Jan.	102,000	70,600	88,300	0·373	0·43
Feb.	140,000	58,000	101,000	0·426	0·44
Mar.	141,000	91,000	110,000	0·464	0·53
April	194,000	88,300	143,000	0·603	0·67
May	635,000	177,000	358,000	1·51	1·74
June	644,000	432,000	537,000	2·27	2·53
July	483,000	323,000	407,000	1·72	1·98
Aug.	315,000	176,000	231,000	0·975	1·12
Sept.	170,000	99,000	125,000	0·527	0·59
Oct.	95,000	76,200	83,600	0·353	0·41
Nov.	93,000	75,400	84,800	0·358	0·40
Dec.	96,000	72,200	84,800	0·358	0·41
Year	644,000	58,000	196,100	0·827	11·25
1904					
Jan.	108,000	89,200	99,600	0·420	0·48
Feb.	165,000	80,200	100,000	0·422	0·46
Mar.	248,000	118,000	168,000	0·709	0·82
April	479,000	164,000	337,000	1·42	1·58
May	629,000	445,000	508,000	2·14	2·47
June	602,000	467,000	559,000	2·36	2·63
July	467,000	261,000	397,000	1·68	1·94
Aug.	254,000	147,000	200,000	0·844	0·97
Sept.	143,000	98,000	122,000	0·515	0·57
Oct.	96,000	75,400	84,700	0·357	0·41
Nov.	78,600	68,300	72,600	0·306	0·34
Dec.	78,600	66,900	71,800	0·303	0·35
Year	629,000	66,900	226,700	0·957	13·02
1906					
Jan.	72,200	59,200	63,500	0·268	0·31
Feb.	102,000	64,100	76,700	0·324	0·34
Mar.	157,000	73,800	92,200	0·389	0·45
April	264,000	165,000	203,000	0·857	0·96
May	345,000	258,000	299,000	1·26	1·45
June	374,000	278,000	332,000	1·40	1·56
July	300,000	229,000	278,000	1·17	1·35
Aug.	223,000	125,000	168,000	0·709	0·82
Sept.	131,000	100,000	115,000	0·485	0·54
Oct.	108,000	85,600	91,700	0·387	0·45
Nov.	260,000	92,000	136,000	0·574	0·64
Dec.	155,000	105,000	123,000	0·519	0·60
Year	374,000	59,200	164,800	0·695	9·47
1908					
Jan.	87,400	66,200	75,200	0·317	0·37
Feb.	69,800	59,900	66,200	0·279	0·30
Mar.	225,000	69,800	116,000	0·489	0·56
April	303,000	110,000	183,000	0·772	0·86
May	401,000	269,000	344,000	1·45	1·67
June	653,000	399,000	537,000	2·27	2·53
July	511,000	316,000	413,000	1·74	2·01
Aug.	310,000	159,000	204,000	0·861	0·99
Sept.	155,000	102,000	121,000	0·511	0·57
Oct.	102,000	83,800	90,400	0·381	0·44
Nov.	97,000	82,900	88,000	0·371	0·41
Dec.	91,000	66,900	78,300	0·330	0·38
Year	653,000	59,900	193,000	0·814	11·09
1910					
Jan.	[illegible]5,000	86,500	108,000	0·456	0·53
Feb	[illegible]22,000	79,400	92,400	0·390	0·41
Mar.	392,000	136,000	272,000	1·15	1·33
April	485,000	249,000	322,000	1·36	1·52
May	566,000	433,000	493,000	2·08	2·40
June	485,000	311,000	397,000	1·68	1·87
July	307,000	197,000	238,000	1·00	1·15
Aug.	197,000	125,000	160,000	0·675	0·78
Sept.	121,000	81,100	93,200	0·393	0·44
Oct.	118,000	81,100	102,000	0·430	0·50
Nov.	150,000	104,000	121,000	0·511	0·57
Dec.	138,000	91,000	113,000	0·477	0·55
Year	566,000	79,400	209,300	0·883	12·05

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
[illegible]					
Jan.	178,000	85,600	117,000	0·494	0·57
Feb.	125,000	73,800	87,700	0·370	0·39
Mar.	192,000	74,600	97,400	0·411	0·47
April	252,000	160,000	191,000	0·806	0·90
May	374,000	240,000	309,000	1·30	1·50
June	787,000	385,000	683,000	2·88	3·21
July	642,000	291,000	426,000	1·80	2·08
Aug.	286,000	174,000	216,000	0·911	1·05
Sept.	172,000	130,000	149,000	0·629	0·70
Oct.	173,000	135,000	155,000	0·654	0·75
Nov.	142,000	123,000	133,000	0·561	0·63
Dec.	135,000	101,000	122,000	0·515	0·59
Year	787,000	73,800	223,800	0·944	12·84
1905					
Jan.	80,200	57,400	66,500	0·281	0·32
Feb.	75,400	52,600	62,900	0·265	0·28
Mar.	130,000	78,600	106,000	0·447	0·52
April	188,000	114,000	131,000	0·553	0·62
May	252,000	172,000	206,000	0·869	1·00
June	412,000	269,000	357,000	1·51	1·68
July	311,000	204,000	246,000	1·04	1·20
Aug.	205,000	124,000	175,000	0·738	0·85
Sept.	121,000	77,800	95,500	0·403	0·45
Oct.	115,000	92,000	103,000	0·435	0·50
Nov.	93,000	73,800	79,000	0·333	0·37
Dec.	76,200	62,700	67,400	0·284	0·33
Year	412,000	52,600	141,300	0·597	8·12
1907					
Jan.	142,000	77,800	105,000	0·443	0·51
Feb.	212,000	113,000	158,000	0·667	0·69
Mar.	251,000	129,000	167,000	0·705	0·81
April	289,000	156,000	234,000	0·987	1·10
May	522,000	248,000	379,000	1·60	1·84
June	587,000	481,000	532,000	2·24	2·50
July	532,000	305,000	431,000	1·82	2·10
Aug.	305,000	178,000	230,000	0·970	1·12
Sept.	180,000	135,000	162,000	0·684	0·76
Oct.	135,000	96,000	116,000	0·489	0·56
Nov.	95,000	83,800	88,100	0·372	0·42
Dec.	118,000	77,800	88,300	0·373	0·43
Year	587,000	77,800	224,200	0·946	12·84
1909					
Jan.	275,000	63,400	107,000	0·451	0·52
Feb.	140,000	84,700	103,000	0·435	0·45
Mar.	130,000	92,000	108,000	0·456	0·53
April	187,000	132,000	150,000	0·633	0·71
May	388,000	173,000	231,000	0·975	1·12
June	675,000	395,000	592,000	2·50	2·79
July	555,000	284,000	422,000	1·78	2·05
Aug.	283,000	146,000	203,000	0·857	0·99
Sept.	154,000	106,000	129,000	0·544	0·61
Oct.	105,000	91,000	101,000	0·426	0·49
Nov.	220,000	90,100	128,000	0·540	0·60
Dec.	198,000	97,000	141,000	0·595	0·69
Year	675,000	63,400	201,300	0·850	11·55
1911					
Jan.	90,100	69,800	79,000	0·333	0·38
Feb.	113,000	63,400	79,200	0·334	0·35
Mar.	154,000	62,700	104,000	0·439	0·51
April	212,000	134,000	154,000	0·650	0·73
May	376,000	215,000	306,000	1·29	1·49
June	574,000	347,000	503,000	2·12	2·36
July	520,000	258,000	378,000	1·59	1·83
Aug.	255,000	136,000	187,000	0·789	0·91
Sept.	135,000	97,000	120,000	0·506	0·56
Oct.	98,000	75,400	84,900	0·358	0·41
Nov.	95,000	73,000	78,100	0·330	0·37
Dec.	77,800	63,400	69,800	0·295	0·34
Year	574,000	62,700	178,600	0·754	10·24

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
1912						**1913**					
Jan.	118,000	52,000	80,800	0·341	0·39	Jan.	87,400	66,900	74,900	0·316	0·36
Feb.	141,000	85,600	110,000	0·464	0·50	Feb.	100,000	63,400	76,400	0·322	0·34
Mar.	111,000	76,200	81,900	0·346	0·40	Mar.	125,000	73,000	98,100	0·414	0·48
April	219,000	113,000	181,000	0·764	0·85	April	308,000	155,000	228,000	0·962	1·07
May	547,000	225,000	372,000	1·57	1·81	May	631,000	246,000	376,000	1·59	1·83
June	568,000	471,000	522,000	2·20	2·46	June	759,000	583,000	694,000	2·93	3·27
July	451,000	218,000	305,000	1·29	1·49	July	574,000	275,000	392,000	1·65	1·90
Aug.	213,000	143,000	180,000	0·759	0·88	Aug.	269,000	157,000	210,000	0·886	1·02
Sept.	156,000	99,000	129,000	0·544	0·61	Sept.	156,000	121,000	141,000	0·595	0·66
Oct.	99,000	85,600	89,200	0·376	0·43	Oct.	120,000	102,000	110,000	0·464	0·53
Nov.	103,000	84,700	93,300	0·394	0·44	Nov.	106,000	98,000	101,000	0·426	0·48
Dec.	92,000	70,600	79,300	0·335	0·39	Dec.	103,000	71,400	82,500	0·348	0·40
Year	568,000	52,000	185,300	0·782	10·65	Year	759,000	63,400	215,300	0·908	12·34
1914						**1915**					
Jan.	111,000	70,000	95,300	0·402	0·46	Jan.	80,200	56,800	70,300	0·297	0·34
Feb.	131,000	77,800	89,800	0·379	0·39	Feb.	82,000	65,500	71,100	0·300	0·31
Mar.	178,000	131,000	150,000	0·633	0·73	Mar.	117,000	69,800	84,100	0·355	0·41
April	276,000	134,000	218,000	0·920	1·03	April	204,000	123,000	167,000	0·705	0·79
May	493,000	260,000	375,000	1·58	1·82	May	325,000	197,000	253,000	1·07	1·23
June	461,000	374,000	423,000	1·78	1·99	June	328,000	220,000	266,000	1·12	1·25
July	367,000	234,000	316,000	1·33	1·53	July	239,000	199,000	224,000	0·945	1·09
Aug.	226,000	130,000	168,000	0·709	0·82	Aug.	199,000	165,000	185,000	0·781	0·90
Sept.	125,000	98,000	109,000	0·460	0·51	Sept.	164,000	82,000	122,000	0·515	0·57
Oct.	112,000	98,000	104,000	0·439	0·51	Oct.	85,600	73,000	77,200	0·326	0·38
Nov.	135,000	105,000	[illegible]	0·511	0·57	Nov.	95,000	75,400	84,300	0·356	0·40
Dec.	114,000	62,000	[illegible]	0·378	0·44	Dec.	104,000	76,200	85,600	0·361	0·42
Year	493,000	62,000	188,200	0·795	10·80	Year	328,000	56,800	140,800	0·594	8·09

YEARLY DISCHARGE OF COLUMBIA RIVER AT THE DALLES—*By calendar years*

Year	Discharge in second-feet						Run-off depth in inches on drainage area	Per cent variation from mean
	Maximum	Minimum	Highest monthly mean	Lowest monthly mean	Annual mean	Per square mile		
1879	643,000	59,600	612,000	65,900	242,700	1·023	13·93	+15·4
1880	914,000	68,300	973,000	75,200	266,400	1·123	15·35	+26·7
1881	598,000	73,800	546,000	86,400	251,800	1·061	14·42	+19·7
1882	883,000	60,400	770,000	66,700	232,600	0·982	13·35	+10·6
1883	573,000	58,800	534,000	73,500	204,300	0·862	11·73	− 2·9
1884	698,000	44,300	648,000	71,900	223,000	0·941	12·82	+ 6·0
1885	482,000	76,000	445,000	93,400	212,400	0·897	12·17	+ 1·0
1886	673,000	62,000	577,000	69,700	203,100	0·857	11·61	− 3·4
1887	896,000	66,100	809,000	75,300	266,800	1·124	15·31	+26·8
1888	564,000	49,400	515,000	80,200	199,600	0·842	11·47	− 5·1
1889	302,000	54,800	268,000	63,700	129,200	0·546	7·41	−38·6
1890	633,000	41,900	559,000	51,400	196,100	0·828	11·24	− 6·8
1891	448,000	57,400	420,000	62,600	170,000	0·717	9·77	−19·2
1892	607,000	66,200	544,000	73,000	197,600	0·834	11·37	− 6·0
1893	679,000	61,300	597,000	71,000	229,700	0·969	13·21	+ 9·2
1894	1,160,000	88,000	970,000	114,000	306,000	1·291	17·54	+45·5
1895	475,000	70,000	381,000	75,300	182,300	0·769	10·50	−13·3
1896	785,000	70,000	679,000	89,300	239,200	1·010	13·73	+13·7
1897	780,000	82,000	624,000	97,100	240,100	1·013	13·78	+14·2
1898	649,000	58,000	603,000	68,500	221,600	0·935	12·68	+ 5·4
1899	787,000	71,400	638,000	98,500	249,500	1·052	14·33	+18·6
1900	536,000	99,000	450,000	114,000	219,700	0·927	12·61	+ 4·5
1901	662,000	77,000	516,000	83,900	208,400	0·880	11·99	− 0·9
1902	644,000	58,000	537,000	83,600	196,100	0·827	11·25	− 6·8
1903	787,000	73,800	683,000	87,700	223,800	0·944	12·84	+ 6·4
1904	629,000	66,900	559,000	71,800	226,700	0·957	13·02	+ 7·8
1905	412,000	52,600	357,000	62,900	141,300	0·597	8·12	−32·8
1906	374,000	59,200	332,000	63,500	164,800	0·695	9·47	−21·6
1907	587,000	77,800	532,000	88,100	224,200	0·946	12·84	+ 6·6
1908	653,000	59,900	537,000	66,200	193,000	0·814	11·09	− 8·2
1909	675,000	63,100	592,000	101,000	201,300	0·850	11·55	− 4·3
1910	566,000	79,400	493,000	92,400	209,300	0·883	12·05	− 0·5
1911	574,000	62,700	503,000	69,800	178,600	0·754	10·24	−15·1
1912	568,000	52,000	522,000	79,300	185,300	0·782	10·65	−11·9
1913	759,000	63,400	694,000	74,900	215,300	0·908	12·34	+ 2·4
1914	493,000	62,000	423,000	89,500	188,200	0·795	10·80	−10·5
1915	328,000	56,800	266,000	70,300	140,800	0·594	8·09	−33·1
Period 1879 to 1915	1,160,000	41,900	970,000	51,400	210,300	0·887	12·07	......

YEARLY DISCHARGE OF COLUMBIA RIVER AT THE DALLES—*By water years*

Year ending Sept. 30	Discharge in second-feet						Run-off depth in inches on drainage area	Per cent variation from mean
	Maximum	Minimum	Highest monthly mean	Lowest monthly mean	Annual mean	Per square mile		
1879	643,000	59,600	612,000	65,900	242,000	1·02	13·85	+14·9
1880	914,000	68,300	793,000	85,400	264,000	1·11	15·18	+25·4
1881	598,000	73,800	546,000	80,700	252,000	1·06	14·46	+19·7
1882	883,000	60,400	770,000	65,700	232,000	0·979	13·27	+10·2
1883	573,000	58,800	534,000	87,100	212,000	0·895	12·14	+ 0·7
1884	698,000	45,800	648,000	71,900	214,000	0·903	12·29	+ 1·6
1885	482,000	44,300	445,000	80,600	214,000	0·903	12·27	+ 1·6
1886	673,000	64,400	577,000	101,000	211,000	0·890	12·07	+ 0·2
1887	896,000	62,000	809,000	69,700	260,000	1·10	14·93	+23·5
1888	564,000	49,400	515,000	80,200	202,000	0·852	11·61	− 4·1
1889	302,000	57,400	268,000	63,700	134,000	0·565	7·67	−36·4
1890	633,000	41,900	559,000	51,400	196,000	0·827	11·21	− 6·9
1891	448,000	57,400	420,000	62,600	165,000	0·696	9·47	−21·6
1892	607,000	63,200	544,000	73,000	198,000	0·835	11·38	− 6·0
1893	679,000	61,300	597,000	71,000	219,000	0·924	12·56	+ 4·0
1894	1,160,000	88,300	970,000	114,000	311,000	1·31	17·77	+47·7
1895	475,000	80,100	381,000	94,000	194,000	0·819	11·13	− 7·9
1896	785,000	70,000	679,000	75,300	229,000	0·966	13·15	+ 8·7
1897	780,000	78,000	624,000	89,300	243,000	1·03	13·87	+15·4
1898	649,000	82,000	603,000	97,100	230,000	0·970	13·19	+ 9·2
1899	787,000	58,000	638,000	68,500	235,000	0·992	13·47	+11·6
1900	536,000	103,000	450,000	125,000	224,000	0·945	12·85	+ 6·4
1901	662,000	81,000	516,000	114,000	219,000	0·924	12·53	+ 4·0
1902	644,000	58,000	537,000	83,900	197,000	0·831	11·30	− 6·5
1903	787,000	72,200	683,000	83,600	211,000	0·890	12·09	+ 0·2
1904	629,000	80,200	559,000	99,600	242,000	1·02	13·89	+14·9
1905	412,000	52,600	357,000	62,900	140,000	0·591	8·02	−33·5
1906	374,000	59,200	332,000	63,500	157,000	0·662	8·98	−25·4
1907	587,000	77,800	532,000	91,700	229,000	0·966	13·12	+ 8·7
1908	653,000	59,900	537,000	66,200	196,000	0·827	11·27	− 6·9
1909	675,000	63,400	592,000	78,300	192,000	0·810	11·00	− 8·8
1910	569,000	79,400	493,000	92,400	213,000	0·809	12·21	+ 1·1
1911	574,000	62,700	503,000	79,000	187,000	0·789	10·74	−11·2
1912	558,000	52,000	522,000	69,800	183,000	0·772	10·51	−13·1
1913	759,000	63,400	694,000	74,900	213,000	0·899	12·19	+ 1·1
1914	49[illegible]	70,600	423,000	82,600	186,000	0·787	10·69	−11·7
1915	328,000	56,800	266,000	70,300	146,000	0·618	8·41	−30·7
Period 1879 to 1915	1,160,000	41,900	970,000	51,400	210,600	0·889	12·07	.....

COLUMBIA RIVER AT THE DALLES

Discharge in sec.-ft. per sq. mile, 1878 to 1915

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	......	......	......	......	......	1·80	1·15	0·776	0·523	0·379	0·352	0·384	....
1879	0·278	0·368	0·764	1·52	1·67	2·58	2·11	1·16	0·650	0·464	0·360	0·360	1·023
1880	0·415	0·326	0·317	0·637	1·70	2·95	3·35	1·63	0·835	0·553	0·439	0·341	1·123
1881	0·451	0·890	0·932	1·63	1·80	2·30	1·82	1·03	0·595	0·464	0·473	0·365	1·061
1882	0·331	0·281	0·403	0·966	1·42	3·25	2·01	1·11	0·633	0·464	0·398	0·511	0·982
1883	0·368	0·369	0·751	0·831	1·70	2·25	1·68	0·852	0·532	0·383	0·313	0·310	0·862
1884	0·303	0·303	0·443	0·857	1·70	2·73	1·70	1·08	0·700	0·561	0·570	0·340	0·941
1885	0·394	0·692	0·797	1·09	1·57	1·88	1·43	0·857	0·654	0·515	0·435	0·435	0·897
1886	0·426	0·751	0·515	0·882	1·44	2·43	1·48	0·848	0·527	0·362	0·294	0·318	0·857
1887	0·418	0·318	0·743	1·09	1·78	3·41	2·47	1·22	0·722	0·481	0·422	0·419	1·124
1888	0·338	0·608	0·503	0·797	1·53	2·17	1·43	0·899	0·640	0·430	0·395	0·361	0·842
1889	0·280	0·269	0·374	0·641	1·07	1·13	0·772	0·629	0·407	0·369	0·327	0·273	0·546
1890	0·217	0·494	0·506	0·810	2·36	1·84	1·38	0·819	0·511	0·376	0·327	0·294	0·828
1891	0·278	0·264	0·311	0·578	1·44	1·77	1·29	0·865	0·557	0·373	0·456	0·421	0·717
1892	0·333	0·308	0·536	0·646	1·26	2·30	1·89	0·886	0·612	0·468	0·414	0·363	0·834
1893	0·328	0·346	0·300	0·717	1·86	2·52	1·96	1·15	0·633	0·515	0·599	0·700	0·969
1894	0·612	0·481	0·688	1·36	2·43	4·09	2·33	1·14	0·738	0·561	0·57[illegible]	0·481	1·291
1895	0·430	0·397	0·502	0·768	1·59	1·61	1·47	0·869	0·544	0·407	0·332	0·318	0·769
1896	0·381	0·391	0·565	0·760	1·13	2·86	2·70	1·08	0·662	0·377	0·515	0·688	1·010
1897	0·485	0·519	0·460	1·26	2·63	2·28	1·57	0·886	0·578	0·410	0·481	0·595	1·013
1898	0·477	0·620	0·620	0·848	1·77	2·54	1·68	1·00	0·603	0·411	0·353	0·289	0·935
1899	0·416	0·460	0·447	0·810	1·30	2·69	2·59	1·30	0·814	0·591	0·549	0·662	1·052
1900	0·709	0·527	0·789	1·15	1·90	1·73	1·36	0·789	0·574	0·481	0·527	0·582	0·927
1901	0·544	0·515	0·789	0·696	1·81	2·18	1·43	0·924	0·557	0·362	0·354	0·390	0·880
1902	0·373	0·426	0·464	0·603	1·51	2·27	1·72	0·975	0·527	0·353	0·358	0·358	0·827
1903	0·494	0·370	0·411	0·806	1·30	2·88	1·80	0·911	0·629	0·654	0·561	0·515	0·944
1904	0·420	0·422	0·709	1·42	2·14	2·36	1·68	0·844	[illegible]	0·357	0·306	0·303	0·957
1905	0·281	0·265	0·447	0·553	0·869	1·51	1·04	0·738	[illegible]	0·435	0·333	0·284	0·597
1906	0·268	0·324	0·389	0·857	1·26	1·40	1·17	0·709	[illegible]	0·387	0·574	0·519	0·695
1907	0·443	0·667	0·705	0·987	1·60	2·24	1·82	0·970	[illegible]	0·489	0·372	0·373	0·946
1908	0·317	0·279	0·489	0·772	1·45	2·27	1·74	0·861	[illegible]	0·381	0·371	0·330	0·814
1909	0·451	0·435	0·456	0·633	0·975	2·30	1·78	0·857	[illegible]	0·426	0·540	0·597	0·850
1910	0·456	0·390	1·15	1·36	2·08	1·68	1·00	0·677	[illegible]	0·430	0·511	0·477	0·883
1911	0·333	0·334	0·439	0·650	1·29	2·12	1·59	0·789	0·506	0·358	0·330	0·295	0·754
1912	0·341	0·464	0·346	0·764	1·57	2·20	1·29	0·759	0·544	0·376	0·394	0·335	0·782
1913	0·316	0·322	0·414	0·962	1·59	2·93	1·65	0·886	0·595	0·464	0·426	0·348	0·908
1914	0·402	0·379	0·633	0·920	1·58	1·78	1·33	0·709	0·460	0·439	0·511	0·378	0·793
1915	0·297	0·300	0·355	0·705	1·07	1·12	0·945	0·781	0·515	0·326	0·356	0·361	0·594
Mean	0·389	0·[illegible]29	0·526	0·901	1·60	2·28	1·67	0·928	0·582	0·438	0·426	0·412	0·887

U.S. 5—FLATHEAD RIVER, NORTH FORK—near Columbia Falls, Mont.

Drainage area, 1,620 square miles*

DESCRIPTION OF GAUGING STATION

Location—At Potter ranch, three-fourths mile above junction with Middle fork of Flathead and about 10 miles northeast of Columbia Falls.

Records available—Sept. 22, 1910, to Dec. 31, 1915.

Gauge—Vertical staff on right bank near ranch buildings.

Bench mark—Spike in top of pine stump 40 feet west of gauge. Elevation 11·36 feet above gauge zero.

Channel—Rocky; clean and practically permanent.

Discharge measurements—Made from cable about three-fourths mile above gauge.

Winter flow—Channel remains open at the control during winter, but discharge relation is affected by anchor ice.

Accuracy—Rating curves are good; results excellent except for short periods during the winter months.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1910				1912			
Sept. 22	C. S. Heidel	1·60	965	July 26	W. A. Lamb	3·44	3,360
Oct. 13	W. A. Lamb	2·94	2,540	1913			
Nov. 26	B. E. Jones	2·51	1,900	June 10	do.	8·15	20,600
1911				Sept. 10	do.	2·13	1,430
Jan. 3	do.	1·00	508	1915			
June 30	W. A. Lamb	5·38	7,820	Sept. 10	do.	2·00	1,260
Aug. 10	J. C. Beebe	2·90	2,530				

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1910					
Jan.	....	....	....	....	....
Feb.	....	....	....	....	....
Mar.	....	....	....	....	....
April	....	....	....	....	....
May	....	....	....	....	....
June	....	....	....	....	....
July	....	....	....	....	....
Aug.	....	....	....	....	....
Sept.[1]	1,030	925	974	0·601	0·21
Oct.	3,890	1,300	2,220	1·37	1·58
Nov.	5,400	1,400	2,310	1·43	1·60
Dec.	1,510	950	1,120	0·691	0·80
Period	....	....	....	....	....
1912					
Jan.[2]	....	....	762	0·470	0·54
Feb.	....	....	657	0·406	0·44
Mar.	870	450	632	0·390	0·45
April	3,690	540	2,510	1·55	1·73
May	10,700	3,320	7,230	4·46	5·14
June	8,480	4,290	6,440	3·98	4·44
July	5,370	2,480	3,930	2·43	2·80
Aug.	2,480	1,340	1,700	1·05	1·21
Sept.	1,910	1,140	1,510	0·932	1·04
Oct.	1,450	960	1,200	0·741	0·85
Nov.	1,190	1,050	1,390	0·858	0·96
Dec.	1,140	640	854	0·527	0·61
Year	10,700	....	2,400	1·48	20·21

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1911					
Jan.	1,450	510	1,050	0·648	0·75
Feb.	1,100	710	917	0·566	0·59
Mar.	1,560	640	983	0·607	0·70
April	7,650	1,290	3,080	1·90	2·12
May	9,600	4,710	6,960	4·30	4·96
June	13,100	7,920	10,800	6·67	7·44
July	7,920	2,330	4,290	2·65	3·06
Aug.	2,480	1,240	1,870	1·15	1·33
Sept.	1,910	1,240	1,550	0·957	1·07
Oct.	1,340	710	1,020	0·630	0·73
Nov.	1,050	350	764	0·472	0·53
Dec.	1,140	510	774	0·478	0·55
Year	13,100	350	2,840	1·75	23·83
1913					
Jan.[2]	....	....	650	0·401	0·46
Feb.	....	....	650	0·401	0·42
Mar.	....	....	650	0·401	0·46
April	7,000	710	2,960	1·83	2·04
May	20,800	3,140	8,580	5·30	6·11
June	23,800	8,880	14,900	9·20	10·26
July	8,880	2,640	4,390	2·71	3·12
Aug.	2,800	1,500	2,050	1·27	1·46
Sept.	1,500	960	1,300	0·802	0·89
Oct.	1,670	960	1,210	0·747	0·86
Nov.	1,240	960	1,100	0·679	0·76
Dec.[2]	960	570	809	0·499	0·58
Year	23,800	....	3,270	2·02	27·52

[1] For period Sept. 22 to 30.

[2] Discharge relation affected by ice, Jan. 3 to Feb. 26, 1912; Jan. 1 to Mar. 3 and Dec. 25 to 31, 1913, also during parts of Jan. and Feb., 1914; discharges partly estimated for these months.

* As estimated by United States Geological Survey.

MONTHLY SUMMARIES—*Contin*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean.	Per square mile			Max.	Min.	Mean	Per square mile	
	1914						1915				
Jan.[1]	1,340	570	901	0·556	0·64	Jan.	1,140	790	939	0·580	0·67
Feb.	790	350	623	0·395	0·41	Feb.	900	710	804	0·496	0·52
Mar.	790	510	647	0·400	0·46	Mar.	1,100	640	803	0·496	0·57
April	5,280	790	3,110	1·92	2·14	April	7,300	1,140	3,780	2·33	2·60
May	12,400	4,620	8,730	5·39	6·02	May	7,600	3,860	5,360	3·31	3·82
June	13,300	4,840	7,380	4·56	5·08	June	8,200	3,860	4,960	3·06	3·41
July	4,840	1,730	3,190	1·97	2·27	July	6,220	2,330	3,540	2·19	2·52
Aug.	1,850	1,240	1,470	0·907	1·05	Aug.	2,330	1,240	1,680	1·04	1·20
Sept.	1,910	1,140	1,380	0·852	0·95	Sept.	1,340	1,140	1,190	0·735	0·82
Oct.	4,040	1,560	2,290	1·41	1·62	Oct.	1,790	1,140	1,420	0·877	1·01
Nov.	4,810	1,790	2,940	1·81	2·02	Nov.	1,340	710	1,150	0·710	0·79
Dec.	1,560	960	1,190	0·735	0·85	Dec.	870	640	706	0·435	0·50
Year	13,300	350	2,820	1·74	23·51	Year	8,200	640	2,190	1·35	18·43

[1] See reference on previous page marked [2].

Note—1910, daily discharges determined from a rating curve fairly well defined below 3,010 second-feet. 1911-1912, daily discharges determined from a rating curve, well defined below 10,000 second-feet. 1913, daily discharges determined from a well defined rating curve that is the same as that used from 1911-1912 below gauge height of 3·6 feet. 1914-1915, daily discharges determined from a well defined rating curve.

U.S. 6—KETTLE RIVER—at Boyd, Wash.

Drainage area, 4,060 square miles*

DESCRIPTION OF GAUGING STATION

Location—800 feet east of Boyd station, on the Oroville branch of the Great Northern.

Records available—Sept. 10, 1913, to Oct. 31, 1915. Station discontinued.

Gauge—Staff in three sections on the right bank, the lower two sections inclined, the upper vertical.

Channel and control—Large gravel and small boulders ; probably shifting in floods.

Discharge measurements—Made from a cable 1,000 feet above the gauge, or by wading.

Winter flow—Seriously affected by ice.

Accuracy—Results good.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1913				June 19	C. O. Brown	6·84	9,360
Oct [illegible]	[illegible] Storey	1·69[1]	1,110	" 20	do.	6·44	8,460
No[illegible]		1·59[1]	1,020	1914			
" [illegible]	[illegible]	1·65[1]	1,070	Aug. 21	C. O. Brown	0·64	435
19[illegible]				" 22	do.	0·63[3]	434
J[illegible] 13	[illegible] Jordan	1·35[1]	881	Sept. 7	do.	0·31	302
" 14		1·25[1]	830	1915			
Fe[illegible]	[illegible]ewart	0·87[2]	490	Aug. 5	do.	3·26	2,930
Jun[illegible]	[illegible]er and Brown	8·65	13,700	" 6	do.	3·14	2,810
"	do.	7·81	12,100	Oct. 8	do.	0·71	530

[1] Readings were observed on the temporary gauge, located at the Great Northern railway bridge, which was used prior to Oct. 17, as follows : Oct. 18, 4·03 ft.; Nov. 3, 3·97 ft.; Nov. 4, 3·99 ft.; Jan. 13, 3·70 ft.; and Jan. 14, 3·55 ft.

[2] Gauge height was affected by ice formation.

[3] Gauge height of 'zero flow' estimated to be −1·1.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
							1913				
Oct.	....	....	....	....	....	Oct.	1,560	785	954	0·235	0·27
Nov.	....	....	....	....	....	Nov.	1,040	830	923	0·227	0·25
Dec.	....	....	....	....	....	Dec.	935	548	692	0·170	0·20

* Estimated by United States Geological Survey. The drainage area in Canada is about 3,100 square miles, and in the United States, 960 square miles.

MONTHLY SUMMARIES—*Continued*

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
			1914						1915		
Jan.	935	548	800	0·197	0·23	Jan.[1]	......	......	800	0·197	0·23
Feb.	865	490	640	0·158	0·16	Feb.[1]	......	......	930	0·229	0·24
Mar.	1,750	617	976	0·240	0·28	Mar.	1,850	411	878	0·216	0·25
April	13,200	1,560	7,010	1·73	1·93	April	11,000	1,920	6,410	1·58	1·76
May	18,000	7,860	12,000	2·96	3·41	May	14,300	7,860	10,700	2·64	3·04
June	16,800	4,760	8,360	2·06	2·30	June	12,800	3,760	6,590	1·62	1·81
July	4,760	795	2,150	0·530	0·61	July	6,190	3,150	4,300	1·06	1·22
Aug.	795	288	512	0·126	0·15	Aug.	3,450	910	1,780	0·438	0·50
Sept.	970	295	458	0·113	0·13	Sept.	840	580	701	0·173	0·19
Oct.	1,560	671	987	0·243	0·28	Oct.	1,060	552	636	0·157	0·18
Nov.	1,950	1,120	1,420	0·350	0·39	Nov.	......	......	......	......	......
Dec.[1]	1,120	590	847	0·209	0·24	Dec.	......	......	......	......	......
Year	18,000	288	3,013	0·743	10·11	Period	14,300	......	3,372	0·831	9·42

[1] Discharge relation seriously affected by ice Dec. 15 to Mar. 3, no measurements made during this interval; flow estimated from observer's notes and from temperature and precipitation records.

U.S. 7—KOOTENAY RIVER—at Libby, Mont.

Drainage area, 11,000 square miles*

DESCRIPTION OF GAUGING STATION

Location—At highway bridge opposite the Great Northern Ry. station, Libby, Mont.

Records available—Oct. 13, 1910, to Dec. 31, 1915.

Gauge—Standard chain gauge attached to left span of the highway bridge. Previous to the completion of the bridge a staff gauge attached to a stump 30 feet above the bridge was used. Feb. 23, 1913, the gauge datum was lowered 2 feet; previous readings reduced to new datum.

Bench-mark—Top of the left-hand pier, downstream side; elevation 28·45 feet above gauge zero.

Channel—Permanent; broken by two piers; bed, small rocks; current fairly swift.

Discharge measurements—Made from the bridge or by boat. Made from the ferry cable prior to the erection of the bridge.

Winter flow—Seriously affected by ice.

Diversions—None of importance.

Accuracy—Records considered excellent.

Co-operation—Maintained in co-operation with the United States Forest Service.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	Sec.-feet			Feet	Sec.-feet
1910							
Oct. 13	J. C. Beebe	4·88	11,300	1913			
1911				Feb 17	B. E. Jones	2·69	3,570
Mar. 15	E. W. Kramer	2·60	3,900	" 18	do.	2·89	4,000
July 31	F. E. Bonner	6·00	18,900	" 19	do.	2·97	4,160
Sept. 27	G. H. Lauts	3·86	7,820	" 20	do.	2·91	4,100
Oct. 10	J. C. Beebe	3·34	5,630	" 22	do.	2·72	3,540
1912				" 24	do.	2·52	3,300
May 6	do.	4·80	10,700	" 25	do.	2·54	3,320
1913				" 27	do.	2·38	2,980
Feb. 3	B. E. Jones	2·39[1]	3,120	Mar. 1	do.	2·35	2,840
" 3	W. A. Lamb	2·30	3,000	" 3	do.	2·35	2,910
" 4	B. E. Jones	2·87	2,920	" 5	do.	2·40	3,080
" 5	do.	2·41	2,570	" 7	do.	2·48	3,300
" 6	do.	2·22	2,170	" 10	do.	2·62	3,620
" 7	do.	2·03	2,160	" 13	do.	2·52	3,390
" 7	do.	2·51	2,180	" 19	do.	2·04	2,510
" 8	do.	2·02	2,110	" 20	do.	2·03	2,530
" 9	do.	2·54	2,000	" 25	do.	2·06	2,550
" 10	do.	2·04	2,050	" 28	do.	2·31	3,020
" 11	do.	2·20	2,270	" 31	do.	2·57	3,610
" 12	do.	2·20	2,310	April 5	do.	2·56	3,620
" 13	do	2·25	2,500	" 26	W. A. Lamb	6·09	16,300
" 14	do.	2·37	2,720	June 11	do.	13·94[2]	73,900
" 15	do.	2·47	2,960	Dec. 16	do.	2·71	4,060

[1] Measurements from Feb. 3 to Mar. 31, 1913, were affected by ice.
[2] Surface velocities observed; coefficient of 0·90 used to reduce to mean velocity.

* Estimated by United States Geological Survey.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1910					
Mar	. . . .	. . . .	. . . .	. . . .	. . . .
April	. . . .	. . . .	. . . .	. . . .	. . . .
May	. . . .	. . . .	. . . .	. . . .	. . . .
June	. . . .	. . . .	. . . .	. . . .	. . . .
July	. . . .	. . . .	. . . .	. . . .	. . . .
Aug	. . . .	. . . .	. . . .	. . . .	. . . .
Sept.	. . . .	. . . .	. . . .	. . . .	. . . .
Oct[1]	10,800	7,560	9,000	0·826	0·58
Nov	10,400	5,970	7,910	0·719	0·80
Dec[2]	5,970	4,530	5,420	0·493	0·2[illegible]
1912					
Jan.	. . . .	. . . .	. . . .	. . . .	. . . .
Feb	. . . .	. . . .	. . . .	. . . .	. . . .
Mar	4,020	2,600	2,930	0·266	0·31
April	11,600	4,020	9,080	0·825	0·92
May	36,100	10,000	22,500	2·05	2·36
June	35,400	17,800	26,100	2·37	2·64
July	27,600	15,000	19,600	1·78	2·05
Aug.	15,000	10,000	12,300	1·12	1·29
Sept.	10,800	6,590	8,940	0·813	0·91
Oct.	7,230	3,670	6,410	0·583	0·67
Nov	7,560	4,390	6,090	0·554	0·62
Dec.	4,140	2,850	3,310	0·301	0·35
Period	36,100	2,600	11,730	1·07	12·12
1914					
Jan.	7,560	2,940	4,260	0·387	0·45
Feb.[5]	3,780	1,690	3,130	0·284	0·30
Mar[5]	5,670	3,330	4,300	0·391	0·45
April	17,300	4,270	11,500	1·05	1·17
May	43,500	15,000	30,700	2·79	3·21
June	56,900	24,700	37,000	3·36	3·75
July	39,000	13,300	25,400	2·31	2·66
Aug.	13,300	7,560	10,100	0·918	1·06
Sept.	9,280	6,280	7,360	0·668	0·74
Oct.	9,650	7,230	8,000	0·727	0·84
Nov	12,800	6,280	8,570	0·779	0·90
Dec[6]	6,280	. . . .	4,270	0·388	0·45
Year	56,900	1,690	12,880	1·17	15·98

Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile	
1911					
Mar[3]	7,890	3,350	5,360	0·487	0·43
April	22,400	6,280	10,600	0·964	1·08
May	29,500	17,800	22,700	2·06	2·38
June	72,500	24,100	53,500	4·86	5·42
July	45,900	15,900	28,700	2·61	3·01
Aug.	17,300	8,920	12,200	1·11	1·28
Sept.	9,650	6,590	8,040	0·731	0·82
Oct.	6,590	4,800	5,780	0·525	0·61
Nov.[4]	6,280	3,780	4,890	0·445	0·43
Dec.				. .	. .
1913					
Jan.	3,330	2,080	2,770	0·252	0·29
Feb.	4,150	2,040	2,990	0·272	0·28
Mar	3,700	2,510	3,110	0·283	0·33
April	23,000	3,550	11,300	1·03	1·15
May	69,600	11,600	26,900	2·45	2·82
June	77,300	40,700	51,700	4·70	5·24
July	31,400	15,000	20,300	1·85	2·13
Aug.	15,900	10,000	13,000	1·18	1·36
Sept.	14,100	7,890	9,580	0·871	0·97
Oct.	8,920	6,280	7,260	0·660	0·76
Nov.	6,280	4,530	5,560	0·505	0·56
Dec.	5,370	2,760	3,730	0·339	0·39
Year	77,300	2,040	13,200	1·20	16·28
1915					
Jan[6]	. .	2,500	3,270	0·297	0·34
Feb.	3,060	2,530	2,790	0·254	0·26
Mar.	5,370	2,620	3,540	0·322	0·37
April	20,800	4,530	11,300	1·03	1·15
May	27,600	15,900	19,600	1·78	2·05
June	34,000	15,900	21,200	1·93	2·15
July	28,800	16,800	20,600	[illegible]·87	2·16
Aug.	15,900	8,920	11,700	1·06	1·22
Sept.	8,920	5,970	6,840	0·622	0·69
Oct.	6,910	5,370	6,180	0·562	0·65
Nov.	7,230	3,780	5,420	0·493	0·55
Dec.	4,800	2,940	3,880	0·353	0·40
Year	34,000	2,500	9,690	0·881	11·99

[1] For period Oct. 13 to 31. [2] Dec. 14 to 31. [3] Mar. 8 to 31. [4] Nov. 1 to 26. [5] Discharges Feb. 7 to 28 and Mar. 9 to 14 determined from fairly well defined rating curve applied to readings on an auxiliary gauge one-fourth mile below the regular gauge. [6] Partly estimated, no gauge heights Dec. 12 to Jan. 2.

Note—Discharge relation was affected by ice during following periods: Dec. 14 to 31, 1910; Jan. 1 to Mar. 7 and Nov. 27 to Dec. 31, 1911; Jan. 1 to Feb. 29 and Nov. 28 to Dec. 31, 1912; Jan. 1 to Mar. 31, 1913. Ice effect probably slight in Dec., 1913; Feb. 6 to 28 and Mar. 9 to 14, 1914. Daily discharges 1910 to 1913 for days unaffected by ice were determined from a rating curve well defined between 3,400 and 25,000 sec.-ft., and fairly well defined above 25,000 sec.-ft. Daily discharges determined in 1914-15, from well defined rating curve. Discharges interpolated for days when no gauge height was reported.

U.S. 8—MOYIE RIVER—at Snyder, Idaho. Drainage area, 717 square miles*

DESCRIPTION OF GAUGING STATION

Location—At the Snyder ranger station, about one-fourth mile west of Snyder station, on the Spokane and International Ry. From Mar. 10, 1911, to Feb. 20, 1912, it was at the Spokane and International Ry. bridge, about one mile below the present situation.

Records available—Mar. 10, 1911, to Dec. 31, 1915.

Drainage area—717 square miles (measured on Cranbrook sheet, British Columbia map, and map of Priest Lake quadrangle).

Gauge—Since Feb. 21, 1912, vertical and inclined staff on left bank 150 feet west of Snyder ranger station; from Mar. 10, 1911, to Feb. 20, 1912, vertical staff attached to left abutment of railway bridge 1 mile below present gauge.

Channel—Stream bed composed of small boulders and gravel; gradient relatively steep; straight both above and below gauge; both banks high and will not overflow; control approximately 500 feet below gauge and formed by gravel and boulder riffle; shifting at high stages.

* Revised estimate by U. S. Geological Survey. About 600 sq. miles of drainage area is in Canada and 117 in United States.

Discharge measurements—Made by wading at gauge or from highway bridge one-fourth mile downstream.

Winter flow—Discharge relation is, at times, seriously affected by ice.

Accuracy—Observer's record apparently reliable, but gaps are frequent owing to his absence. Curve fairly well defined between 200 and 3,000 sec.-ft. Discharge relation affected by ice for short periods each winter; estimates approximate. For periods in which ice is not present and record is continuous, results are apparently good. Monthly summaries given below have been recently revised.

Co-operation—Field data furnished by the U. S. Forest Service.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1911							
Mar. 10	E. W. Kramer	3·24	230	May 14	J. C. Beebe	6·60	3,410
June 15	F. E. Bonner	6·50	4,360	1913			
July 30	do.	3·60	413	Aug. 16	F. B. Storey	3·56	286
Sept. 26	G. H. Lauts	3·25	313	1914			
Oct. 13	Beebe and Leidl	3·30	216	Jan. 15	L. W. Jordan	3·90	472
1912				" 16	do.	3·85	446
Feb. 20	J. C. Beebe	2·98[1]	124	Feb. 28	E. W. Kramer	3·40	223
May 9	do.	6·14[1]	2,950	June 11	do.	5·70	2,400

[1] Gauge heights on old gauge for the 1912 measurements are 2·99, 5·80 and 6·30 feet, respectively.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
						1911					
Mar.	....	....	....	....	....	Mar.[2]	1,110	221	679	0·946[1]	0·77
April	....	....	....	....	....	April	3,970	364	1,610	2·24	2·50
May	....	....	....	....	....	May	6,450	1,910	2,820	5·33	5·13
June	....	....	....	....	....	June	5,580	1,780	3,770	5·[illegible]	5·86
July	....	....	....	....	....	July	1,910	288	849	1·18	1·36
Aug.	....	....	....	....	....	Aug.	288	161	249	0·348	0·40
Sept.	....	....	....	....	....	Sept.	200	161	174	0·243	0·27
Oct.	....	....	....	....	....	Oct.	242	200	220	0·307	0·35
Nov.	....	....	....	....	....	Nov.[3]	....	....	175	0·244	0·27
Dec.	....	....	....	....	....	Dec.[3]	....	....	151	0·211	0·24
1912						1913					
Jan.[3]	391	100	221	0·308	0·36	Jan.[3]	....	....	216	0·301	0·35
Feb.	200	110	144	0·201[1]	0·21	Feb.	455	265	314	0·438	0·46
Mar.	342	91	147	0·205	0·24	Mar.	315	265	280	0·391	0·45
April	2,200	455	1,430	1·86	2·08	April	3,090	265	1,640	2·29	2·56
May	4,120	1,540	2,940	4·10	4·72	May	8,020	1,540	4,380	6·11	7·04
June	2,200	550	1,220	1·70	1·90	June	8,020	1,340	3,640	5·08	5·67
July	1,080	550	710	0·990	1·14	July	1,[illegible]10	310	763	1·06	1·22
Aug.	425	171	243	0·339	0·39	Aug.	310	170	251	0·350	0·40
Sept.	315	171	219	0·306	0·34	Sept.	265	180	219	0·305	0·34
Oct.	265	171	202	0·282	0·33	Oct.[4]	....	....	218	0·304	0·25
Nov.	840	171	479	0·668	0·75	Nov.	....	....	....	....	....
Dec.	315	171	199	0·278	0·32	Dec.[5]	....	....	178	0·248	0·22
Year	4,120	91	673	0·940	12·78	Year	....	....	....	....	....
1914						1915					
Jan.	1,030	170	423	0·590	0·68	Jan.	187	140	163	0·227	0·26
Feb.[3]	274	....	220	0·307	0·32	Feb.	154	100	128	0·179	0·19
Mar.	820	224	487	0·679	0·78	Mar.	595	125	258	0·360	0·42
April	3,820	665	2,160	[illegible]	3·36	April	2,570	440	1,460	2·04	2·28
May	6,120	2,830	4,460	6·22	7·17	May	2,320	1,540	1,820	2·54	2·93
June	4,760	1,540	2,560	3·57	3·98	June	1,440	595	901	1·26	1·41
July	1,440	310	743	1·04	1·2[illegible]	July	665	334	470	0·656	0·76
Aug.	288	125	190	0·265	0·3[illegible]	Aug.	310	125	195	0·272	0·31
Sept.	270	100	145	0·202	[illegible]	Sept.	170	120	136	0·190	0·21
Oct.	265	154	213	0·297	[illegible]	Oct.	224	140	158	0·220	0·25
Nov.	1,160	386	666	0·[illegible]29	[illegible]	Nov.	224	187	206	0·287	0·32
Dec.[6]	412	....	221	0·308	0·36	Dec.	217	154	186	0·259	0·30
Year	6,120	....	1,041	1·45	19·77	Year	2,570	100	507	0·707	9·64

[1] Drainage area of 717 square miles, as estimated for new location, has been used for computations for last two columns for period Mar., 1911, to Feb., 1912, when gauge was at old situation one mile below; the difference in drainage area between old and new situation is not sufficient to make any material difference. [2] For period Mar. 10 to 31. [3] Partly estimated. [4] Oct. 1 to 22. [5] Dec. 8 to 31. [6] Affected by ice Dec. 10 to 31, discharge partly estimated.

Note—Discharges interpolated for days of missing gauge heights, except period Oct. 23 to Dec. 7, 1913. Discharge relation affected by ice, Nov. 15 to Dec. 16, and Dec. 26 to 31, 1911; Jan. 1 to 18, 1912; Jan. 9 to 21 and Feb. 17 to 24, 1913; Feb. 4 to 7 and Dec. 10 to 31, 1914; Jan. 1 to 3 and 28 to 30, 1915.

U.S. 9—SKAGIT RIVER—near Marblemount, Wash. **Drainage area, 1,090 square miles***

DESCRIPTION OF GAUGING STATION

Location—At proposed power-house site of the Skagit Power Co., 1 mile above Goodell creek, and about 16 miles above Marblemount.

Records available—Dec. 21, 1908, to May 23, 1914. Station discontinued.

Gauge—Vertical staff on right bank. Several gauges, all at the same datum and location, have been used since the station was established.

Bench mark—Highest point of a large rock on right bank 31 feet below cable, and about 20 feet from water's edge at medium stages. Elevation, 18·45 feet, gauge datum ; 509·38 feet, sea-level datum.

Channel—Heavy boulders ; shifting in extreme floods.

Discharge measurements—Made from a cable at the gauge.

Accuracy—Results good.

Co-operation—Gauge height record and a part of the discharge measurements furnished by the Skagit Power Co.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*
1908			
Dec. 21	G. L. Rogers	1·70	1,690
" 22	do.	1·70	1,690
" 23	do.	1·60	1,570
" 24	do.	1·60	1,680
" 28	M. S. Halstead	2·37	2,520
" 29	do.	2·23	2,380
" 30	do.	2·20	2,020
" 31	do.	1·90	1,840
1909			
Jan. 1	do.	1·70	1,670
" 2	do.	1·85	1,830
" 3	do.	2·22	2,370
" 4	do.	2·05	2,000
Feb. 3	L. R. Allen	1·97	1,870
" 3	do.	1·96	1,870
" 15	M. S. Halstead	1·33	1,380
" 20	Halstead and Babcock	1·80	1,750
" 25	Halstead and Rogers	1·52	1,490
Mar. 27	M. S. Halstead	2·41	2,440
" 30	do.	2·70	2,710
April 1	G. L. Rogers	3·28	3,520
May 3	do.	4·64	6,010
" 4	do.	6·00	8,530
" 11	do.	4·15	5,070
" 30	do.	6·98	10,400
June 7	do.	7·72	13,000
" 21	J. C. Stevens	7·90	13,500
July 1	J. E. Rossell	6·80	10,300
" 13	G. L. Rogers	6·00	8,260
1909			
July 19	G. L. Rogers	4·69	5,820
Aug. 5	do.	3·70	4,220
" 28	J. E. Rossell	3·46	3,690
" 30	do.	3·15	3,270
Sept. 13	G. L. Rogers	2·52	2,490
Oct. 30	do.	1·62	1,660
Dec. 15	J. E. Rossell	3·90	4,570
1910			
Dec. 29	H. P. Gilkey	2·64	2,[illegible]
1911			
Mar. 8	do.	[illegible]·19	1,050
" 14	F. C. Ebert	[illegible]·19	990
" 14	J. E. Rossell	[illegible]19	1,060
Sept. 12	W. W. Clifford	[illegible]·96	3,000
1912			
June 4	H. C. Hanson	5·85	6,830
Oct. 23	F. B. Sto[illegible]	1·44	1,170
1913			
Aug. 15	Parker and Chandler	3·08	2,980
" 1[illegible]	do.	3·08	2,930
Oct. 14	Stewart and Laville	4·34	4,770
19[illegible]			
Jan. 2[illegible]	Laville and Emery	2·46	2,420
May 6	Parker and Collier	5·76	7,000
" 7	do.	5·71	7,020
" 14	I. L. Collier	9·09	15,600
Aug. 27	Hoyt and Parker	2·88 [1]	2,770
Sept. 16	I. L. Collier	1·51 [2]	1,360

[1] Measurement made at Reflector Bar 7 miles above, and inflow between estimated at 100 sec.-ft.

[2] Measurement made at Reflector Bar 7 miles above, and inflow between estimated at 85 sec.-ft

* Estimated by U. S. Geological Survey. Revised estimate based on recent measurements, using the latest maps available for the portion of the drainage area in British Columbia, gives 1,165 square miles. This revised estimate has been used in computations for monthly summaries. Drainage area in Canada 390 sq. miles, in United States 775 sq. miles.

MONTHLY SUMMARIES

Month	Discharge in second-feet				Run-off depth in inches on drainage area	Month	Discharge in second-feet				Run-off depth in inches on drainage area
	Max.	Min.	Mean	Per square mile			Max.	Min.	Mean	Per square mile	
	1909						1910				
Jan.	4,500	1,520	2,010	1·72	1·98	Jan	5,390	1,500	2,310	1·98	2·28
Feb.	1,880	1,360	1,600	1·37	1·43	Feb.	3,010	1,470	1,890	1·62	1·69
Mar.	3,100	1,320	1,750	1·50	1·73	Mar.	9,840	1,880	5,120	4·39	5·05
April	3,900	2,340	3,100	2·66	2·98	April	26,300	3,770	8,720	7·48	8·35
May	14,600	3,390	7,880	6·77	7·80	May	27,600	9,200	15,800	13·57	15·66
June	27,400	9,100	15,100	12·96	14·46	June	20,200	7,020	11,200	9·62	10·73
July	14,500	5,900	8,880	7·62	8·77	July	13,400	5,880	8,980	7·71	8·88
Aug.	9,970	2,500	4,160	3·57	4·10	Aug.	6,860	1,840	4,060	3·48	4·01
Sept.	4,690	1,790	2,890	2·48	2·77	Sept.	3,420	1,450	2,160	1·85	2·07
Oct.	3,620	1,600	2,170	1·86	2·14	Oct.	16,300	2,910	6,330	5·44	6·25
Nov.	47,200	1,580	8,620	7·40	8·25	Nov.	21,300	3,210	7,040	6·04	6·74
Dec.	19,400	1,760	4,640	3·98	4·58	Dec.	4,150	2,170	2,940	2·52	2·90
Year	47,200	1,320	5,240	4·50	60·99	Year	27,600	1,450	6,410	5·50	74·61
	1911						1912				
Jan.	2,350	1,240	1,690	1·45	1·67	Jan.	3,910	970	1,560	1·34	1·54
Feb.	1,240	870	1,020	0·876	0·91	Feb.	2,840	1,490	2,270	1·95	2·10
Mar.	4,260	920	1,890	1·62	1·87	Mar.	1,780	920	1,210	1·04	1·20
April	7,500	2,350	3,760	3·23	3·60	April	3,580	2,110	2,890	2·48	2·78
May	17,500	5,380	8,540	7·33	8·43	May	18,900	3,120	9,970	8·55	9·85
June	26,500	9,120	15,000	12·88	14·38	June	16,200	6,840	11,800	10·12	11·30
July	11,900	5,780	8,590	7·37	8·48	July	7,720	3,740	6,080	5·22	6·00
Aug.	6,410	2,980	3,970	3·41	3·93	Aug.	5,190	1,890	3,650	3·13	3·60
Sept.	5,000	1,490	2,920	2·50	2·79	Sept.	2,470	1,170	1,680	1·44	1·61
Oct.	1,680	920	1,250	1·07	1·23	Oct.	2,110	920	1,230	1·06	1·22
Nov.	4,810	880	1,900	1·63	1·82	Nov.	6,410	1,030	2,240	1·92	2·14
Dec.	2,230	1,170	1,620	1·39	1·60	Dec.	2,230	1,240	1,530	1·31	1·51
Year	26,500	870	4,360	3·74	50·71	Year	18,900	920	3,840	3·29	44·85
	1913						1914				
Jan.	1,400	920	1,090	0·936	1·08	Jan.	17,700	1,240	4,020	3·45	3·96
Feb.	4,080	820	1,520	1·30	1·35	Feb.	2,210	1,240	1,430	1·23	1·28
Mar.	2,000	1,240	1,520	1·30	1·50	Mar.	5,000	1,890	3,080	2·64	3·04
April	9,360	1,320	4,310	3·70	4·12	April	8,420	2,430	5,770	4·95	5·53
May	20,300	3,270	10,600	9·10	10·48	May[1]	16,700	5,810	10,300	8·85	7·58
June	28,100	11,400	17,000	14·59	16·29	June	......	......	......	......	......
July	13,500	5,580	9,710	8·33	9·60	July	......	......	......	......	......
Aug.	7,950	2,590	4,700	4·03	4·63	Aug.	......	......	......	......	......
Sept.	15,000	1,890	3,540	3·04	3·39	Sept.	......	......	......	......	......
Oct.	6,860	1,320	2,850	2·44	2·81	Oct.	......	......	......	......	......
Nov.	6,320	1,890	3,060	2·63	2·93	Nov.	......	......	......	......	......
Dec.	3,150	1,240	1,860	1·60	1·84	Dec.	......	......	......	......	......
Year	28,100	820	5,147	4·41	60·02	Period	......	......	......	......	......

[1] For period May 1 to 23, 1914; station discontinued.

NOTE.—Daily discharges Jan. 1, 1909, to May 9, 1910, determined from a rating curve well defined between 1,3 and 14,000 second-feet. Discharges subsequent to May 9, 1910, determined from rating curve well defined betwe 1,000 and 14,000 second-feet.

U.S. 10—SKAGIT RIVER—at Reflector Bar, near Marblemount, Wash.

Drainage area, 1,300 square miles

DESCRIPTION OF GAUGING STATION

Location—Just below the mouth of cañon Diablo, three-fourths mile above Stetattle creek a 23 miles above Marblemount.

Records available—Dec. 1, 1913, to Dec. 31, 1915.

Gauge—Stevens automatic gauge referred to an inclined staff on the right bank.

Channel and control—Sand, gravel, and rocks; probably shifting in high water.

Discharge measurements—Made from a cable 60 feet below the gauge.

Accuracy—Results good.

* As estimated by the U. S. Geological Survey. A revised estimate based on recent measu ments, using the latest map available for the portion of the drainage area in British Columbi gives 1,095 square miles. This revised estimate has been used in computations for month summaries below. Drainage area in Canada about 390 sq. miles, in United States about 7 sq. miles.

DISCHARGE MEASUREMENTS

Date	Hydrographer	Gauge height	Discharge	Date	Hydrographer	Gauge height	Discharge
		Feet	*Sec.-feet*			*Feet*	*Sec.-feet*
1914				1913			
Jan. 26	Laville and Rhode	2·79	1,900 [1]	Feb. 19	J. T. Hartson	1·84	800
May 8	Parker and Collier	4·90	6,400	" 20	do.	1·83	770
" 15	I. L. Collier	7·19	14,300	July 20	C. G. Paulsen	3·55	3,140
Aug. 26	Parker and Hoyt	3·23	2,580	Sept. 10	do.	2·32	1,300
Sept. 15	I. L. Collier	2·37 [2]	1,300				

[1] Corrected for angle of current. [2] Zero flow, $0{\cdot}6 \pm 0{\cdot}3$.

MONTHLY SUMMARIES

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
Dec.	....	....	....	....	....
1914					
Jan.	12,800	1,150	3,590	3·28	3·77
Feb.	1,820	1,080	1,250	1·14	1·19
Mar.	4,120	1,670	2,800	2·56	2·95
April	7,740	2,390	5,350	4·88	5·44
May	14,400	5,480	9,180	8·38	9·66
June	13,600	5,760	8,490	7·75	8·64
July	9,560	3,320	6,010	5·48	6·31
Aug.[1]	3,800	....	3,200	2·92	3·37
Sept.	3,200	1,280	1,950	1·78	1·99
Oct.	3,200	1,240	1,910	1·75	2·02
Nov.	5,630	2,560	3,840	3·52	3·92
Dec.	3,500	1,060	1,730	1·58	1·82
Year	14,400	1,060	4,108	3·75	51·08

Month	Discharge in second-feet: Max.	Min.	Mean	Per square mile	Run-off depth in inches on drainage area
1913					
Dec.[1]	......	1,190	1,820	1·66	1·92
1915					
Jan.	1,110	739	899	0·82	0·94
Feb.	815	739	769	0·70	0·73
Mar.	2,920	824	1,560	1·42	1·64
April[1]	10,700	3,020	5,200	4·75	5·30
May[1]	6,260	3,500	4,520	4·12	4·74
June	5,840	2,650	3,920	3·58	4·00
July	5,060	2,560	3,590	3·28	3·78
Aug.	4,230	2,650	3,480	3·18	3·66
Sept.	2,740	962	1,500	1·37	1·53
Oct.[1]	6,020	789	1,830	1·69	1·95
Nov.	4,340	1,280	2,040	1·86	2·08
Dec.	3,600	1,170	1,880	1·72	1·98
Year	10,700	739	2,599	2·37	32·33

[1] Partly estimated.

Note—Daily discharges determined from rating curve, which is well defined between 1,200 and 15,000 second-feet.

CHAPTER XVII

Diagrams Showing the Distribution of Precipitation, Temperatur and Run-off in British Columbia

THE following diagrams will readily serve to impart a general knowled of the distribution of precipitation, temperature and run-off in Britis Columbia. A careful study of the diagrams, in conjunction with the topo graphic descriptions previously given and a good map, will clearly indica the geographical trend of the meteorological and hydrological phenomen throughout the province. It will be observed that the most extensive recor are for the southern and more settled portions of the province.* A knowled of the trend, as disclosed by the diagrams, will be of assistance in interpreti corresponding but less complete data for other districts. The following bri explanation of the plates will assist to an understanding of some of the chi characteristics of the phenomena under discussion.

Arrangement of Diagrams

The diagrams † are arranged to show, primarily, the broa differences between characteristic precipitation, temperatu and run-off phenomena of the Pacific littoral lying to the we of the summit of the Coast mountains and Cascade mountains, and the corre ponding phenomena of the territory lying to the east of said ranges an embracing the interior plateau and the easterly mountain systems. The Pacif littoral, or westerly division, has a marine climate, with heavy precipitatio and run-off and a moderate range of temperature ; the interior, or easter division, has a continental climate, with much less precipitation, a great range of temperature, and different run-off characteristics. In addition this broad classification, records from selected stations are grouped to show t characteristic phenomena for various districts. Thus, for the precipitatio and temperature diagrams, the grouping of stations is as follows :

West and south of Coast Mountains	*East of Coast Mountains*
Fraser River Delta and Lower Valley	Interior, north of the Railway Be
Mainland Pacific Coast	Dry Belt, south
Vancouver Island, south and east	Arrow and Kootenay Lakes distri
Vancouver Island, west and north	Intermontane Valley, south

Selection of Precipitation and Temperature Data for Diagrams

In selecting, from the tabular records, the precipitation an temperature data to be used for the diagrams, attention w paid both to the geographic distribution of the stations an to the length and completeness of the records. Where a clo comparison of the diagrams reveals some anomalies, reference to the d tailed records will usually disclose the actual cause of the seeming di

* Consult map showing precipitation stations.

† Diagrams appear on pp. 493-502, following the text of this chapter.

crepancies. For example : Abnormal precipitation may be recorded for a certain month for one station, while, for another station, the record for the same month may be missing. No attempt has been made to interpolate for missing records. For any month of the year, variations in mean monthly temperature over a period of years are small compared with variations recorded in amounts of monthly precipitation. For this reason, less temperature data and from fewer stations will suffice satisfactorily to show temperature conditions. Also, for records of equal length, variations of the recorded means from the true means will be less for temperature records than for precipitation records (see discussion in Chapter XVIII, Meteorological Data, which follows). In addition to other information, the diagrams summarize data from 78 precipitation stations, from 24 temperature stations and from 17 stream-flow stations.

Precipitation Diagrams

Plates A, B and C show the monthly distribution of precipitation. Beneath the name of each station are given three sets of figures; the centre one is the elevation in feet of the station ; the right hand figure gives the mean annual total precipitation in inches, and the group of figures on the left gives the period of the record, in the same manner as given in the 'List of Precipitation Stations'. For example, for Princeton, the elevation is 2,111 feet, the mean annual total precipitation is 13·41 inches, and the figures 16-39-5 show that the record is for 16 complete calendar years, and in addition, there are 39 complete months recorded in 5 incomplete years. Some of the outstanding characteristics revealed by the precipitation diagrams are as follows :

The extremely small precipitation over the southern Dry Belt, Plate A, column 1, which extends also over the interior north of the Railway Belt, Plate A, column 3, is clearly manifested. The relatively large proportion which falls in the summer months, May to August, will be noticed ; indeed, the average rainfall in July and August recorded at some stations in the Dry Belt actually exceeds the fall for the same months at some stations on the Coast and on Vancouver island. The least monthly precipitation in the Dry Belt and over the Interior generally occurs in March or April. The increase of precipitation with altitude is seen by comparing Hedley with Hedley-Nickel Plate Mine, Plate A, column 1. The similar amounts and monthly distributions, of the mean precipitation for stations in the same vicinity at similar elevation, and having records of similar length, is well illustrated by Enderby and Salmon Arm, Plate A, column 1. The marked increase of precipitation on the western slopes of the Columbia mountain system * is apparent from the first three stations of column 2 on Plate A. Increased precipitation moving from west to east across the Interior plateau towards the slopes of the Columbia mountain system, is shown by the diagrams for Chilcotin, Quesnel, Quesnel Forks and Barkerville, Plate A, column 3. The records for Pemberton Hatchery, which is situated among the Coast mountains, more closely resemble the records for stations west of the Coast mountains (compare Powell River).

* Respecting Columbia mountain system, see chapter IX, *General Topography*.

Precipitation records for stations in, and near, the Fraser River de and lower valley, shown on Plate A, column 4, and Plate B, columns 1 and clearly manifest the general similarity of the monthly distribution of the prec itation throughout the district, with July and August as the dryest months a November the wettest. The increased precipitation in the vicinity of t mountains to the north, is revealed by the records for Coquitlam lake a Buntzen lake.

The distribution of precipitation on the Coast is shown on Plate B, colum 3 and 4. The differences in total precipitation are understandable by care consideration of the situations of the various stations in relation to the mou tain systems. Bellakula lies a long way back from the general coast line, the head of an inlet. Powell River is situated nearer the Pacific ocean, but i region of lesser precipitation, extending over the area near St. George chann lying between the Vancouver Island mountains and the Coast mountai Swanson Bay, on the other hand, receives the full effect of the moisture-lad southwesterly breezes. On this portion of the coast, these breezes are u obstructed in their passage until deflected upward—with consequent p cipitation—by the mountains near this station. For the stations fart north, it may be observed that the maximum monthly precipitation occurs October instead of November, the dryer months being also earlier in the ye *viz.*, May, June and July. See Nass Harbour, Port Simpson, and Sitka. Sit has the longest record on the coast, and the uniform fluctuation of the me monthly precipitation is noteworthy (compare the long-period record f Victoria, Plate C, column 3).

For precipitation conditions on Vancouver island, see Plate C. The mo noticeable characteristics are, first, the heavier precipitation on the west coa and north, and, second, the low precipitation recorded in the summer mont especially July and August. The latter fact will explain the low run-off the end of the summer on streams on the island not fed by glaciers (see belo

On Plate D the variations in annual total precipitation are shown for few long-term records at British Columbia stations. It may just be mention that the noticeable cycle of wet and dry years shown for Victoria is corroborat by U. S. Weather Bureau records for stations in the vicinity of the strait Juan de Fuca and Puget sound.

Temperature Diagrams

Plate E shows the fluctuation of the mean monthly temper tures throughout the year at selected stations. The fo groups to the left are west, and those to the right are ea of the Coast mountains. The difference between these two sets is mo marked. With the single exception of Bellakula—which is situated f from the general coast line, at the head of a long inlet—no station c the Pacific littoral has, for any month of the year, an average mea monthly temperature which falls below 32 degrees Fahr. The differe form of the curve for Bellakula, indicating a higher summer temperature a a lower winter temperature, at the heads of the inlets, is also noticeable in t case of Alberni, V.I. As confirmatory of the lower winter temperature in suc

situations, it may be mentioned that Gardner canal sometimes freezes over for a distance of 25 miles from its head.*

The diagrams to the right show temperature conditions in the Interior. In some instances, the variations due to difference of latitude and elevation of the stations are discernible, although frequently an explanation of the differences, which are more marked than in the case of the coastal stations, must be sought elsewhere, as for example in the situations of the stations with respect to mountain ranges.†

Selection of Stream-flow Data for Diagrams The run-off diagrams show, primarily, the broad differences between conditions to the east and to the west of the Coast mountains and the Cascade mountains. It is only in recent years that stream flow data have been systematically gathered in the west. The majority of the longest records cover periods of less than 10 years. Some of the diagrams have necessarily been based upon run-off records of four years or even less. In most instances, there was little choice in the selection of records. For the shorter records, all data available have been utilized, but, for the longer term records, an even period of years has sometimes been selected.

The unit of comparison for run-off is that commonly employed, *viz.*, cubic feet per second per square mile.

Run-off Diagrams Plates F, G, H and the upper half of Plate I illustrate the monthly distribution of run-off. At the head of each diagram are given, the name of the stream and the approximate situation of the gauging station, the period for the records used in preparing the diagram, and the drainage area in square miles. ‡

Legend For each month of the year there are three quantities represented—expressed in second-feet per sq. mile—the highest

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*See 'Report on Winter Examination of Inlets, British Columbia,' in *Report on Surveys and Preliminary Operations on the Canadian Pacific Railway up to January, 1877*, by Sandford Fleming, Appendix J, pp. 177, *et seq.*, Ottawa, 1877.

† It was not considered advisable to draw on each diagram of *Plate E* records for more than three stations. Among the longer records available in the respective districts, however, it may be mentioned that in diagram I, in the first column, the curve for Masset, Queen Charlotte islands, if drawn, would follow closely the curve for Rivers Inlet, but would be about 2 degrees lower throughout. In diagram II, the curve for Quatsino would lie between the curves for Clayoquot and Holberg. In diagram III, a curve for Cowichan would follow very closely the curve for Nanaimo. In diagram IV, a curve for Agassiz would follow the curve for Vancouver, except for November to January, when it would be somewhat lower. In the second column, the variations between curves for stations are somewhat greater, but it may be stated that, if drawn in diagram I, the curve for Chilcotin-Big Creek would follow the form of that for Quesnel, but would be, throughout, a few degrees lower. Similarly, the curve for Fort St. James would also lie between those for Quesnel and Atlin, averaging about 2 degrees warmer than Atlin in the summer months and being several degrees less cold in the winter season. In diagram II, a curve for Princeton would closely follow the curve for Nicola Lake, except in January and February, when the mean temperature is lower; also, a curve for Vernon would be very close, throughout, to the curve for Kelowna-Okanagan Mission. A curve for Hedley-Nickel Plate Mine, elevation 4,500 feet, would be lower throughout than the curves on this diagram, especially noticeable in May and June, possibly due to the later melting of the snow at higher elevations. In diagram III, a curve for Rossland would closely follow the curve for Revelstoke.

‡ With respect to the drainage areas, it is recognized (see discussion on pages 210 and 310) that the estimates given in some cases, especially for the smaller watersheds, may be somewhat in error. It is believed, however, that in the stations utilized for the diagrams, the errors in estimates of drainage areas are not large enough to affect deductions based upon comparisons of diagrams. In any event, errors do not affect comparisons made within the compass of any one diagram.

mean monthly discharge recorded during the period of record, the mean the monthly discharges recorded during the period of record, and the low mean monthly discharge recorded during the period of record (see legend Plates F, G, and H). A scale of the actual discharge in second-feet is gi for each diagram.

In order to permit of direct comparison, the same scale has been ma tained for the various run-off diagrams. In making comparisons, howev it should be borne in mind that, without exception, the drainage areas stations diagrammed east of the Coast mountains and the Cascades are lar than for those to the west ; moreover, for the more extensive watersheds, culture is more widely diversified, varying from the glaciers and snowfields the mountain ranges to the arid region of the dry belt. The dry belt, for cert periods of the year, is practically a non-contributing run-off area. The wat sheds of the coastal streams have not so marked a diversity of culture. the smaller watersheds forming part of the larger interior drainage basins, should expect to find greater ranges between high-water and low-water sta than are shown on Plate F. We should, however, still find the same gene distribution of annual run-off throughout the different months of the ye Winter months would have a low run-off rate, because the precipitation then largely stored in the snowfields and glaciers. The melting of these, the spring and early summer, causes the characteristic spring freshet. T average date of peak flood depends largely upon the nature of the topograp chiefly upon the elevations within the watershed and the mean latitude the drainage area. Generally speaking, the greater the proportion of a at high elevation and the further north the latitude, the later in the seas will be the melting of the snowfields, and, consequently, the occurrence the peak flood. It will be clear, therefore, that, for any drainage basin British Columbia east of the Coast mountains, a run-off diagram will exhi the same general characteristics as those shown on Plate F.

For run-off characteristics of streams in the coastal belt, including Va couver island, see Plates G, H and I. The chief features are, first, the gre increase in the average yearly run-off per square mile, and second, the mo even distribution of run-off throughout the year. Where the drainage ba includes large areas of high mountains, some of the winter precipitation stored as snow, which, later, contributes to the spring freshet. There usually, another high-water period, corresponding to the time of autumn rai As a rule, the greatest floods of the year occur in October or November, when spell of warmer weather, combined with heavy rain, causes excessive melting the early snow on the higher levels.

Respecting individual diagrams: On Plate F are shown two diagrams f the Columbia river at The Dalles.* One is based on the full record of years and the other is for a period of 5 years ending 1915. This latter peri corresponds more nearly to the period on which many of the other diagrams a based. It will be observed that the mean monthly run-off for correspondi months is very similar, but, that the highest monthly means show mark

* For comments respecting this station, see record in U. S. Stream-flow Data, Chapter X

increases, such as one would naturally expect to be manifested by long-term records.

On the lower half of Plate I is shown the annual run-off depth in inches on drainage area for the Columbia river at The Dalles; in the first diagram the 'water year' ending Sept. 30 is used and in the second the calendar year. The similarity in the diagrams is marked. Below these is one for the yearly variation in run-off. It shows the maximum daily, highest monthly, yearly mean, lowest monthly and minimum daily discharges, each expressed in second-feet per square mile.

In the diagram for the Columbia river at Castlegar (Plate F), the watershed of which includes a large proportion of the western flanks of the more massive and higher portion of the Selkirk mountains, the shifting of the average peak of the run-off curve to a period later in the year than for the Columbia at The Dalles, or the Pend-d'Oreille at Metaline Falls, may be discerned, thus showing the influence of elevation on run-off. The influence of latitude is manifested in the diagram for the Fraser river at Hope. Here, a similar shifting of the peak is manifested, due to the more northerly position of the Fraser drainage basin as compared with that of the Columbia at The Dalles or the Pend-d'Oreille at Metaline Falls.

In the diagrams on Plate G, those for the Coquihalla, Chilliwack and Skagit rivers may be said to represent the transition stage from the stream-flow characteristics of the interior to those of the coastal type of stream. The mean monthly discharges are still highest in the early summer months, due to the augmentation of the flow by the melting snows at the higher elevations, but the mean annual discharge per square mile is much greater, also the influence of the heavy autumn and winter precipitation is seen in higher run-off for corresponding months.

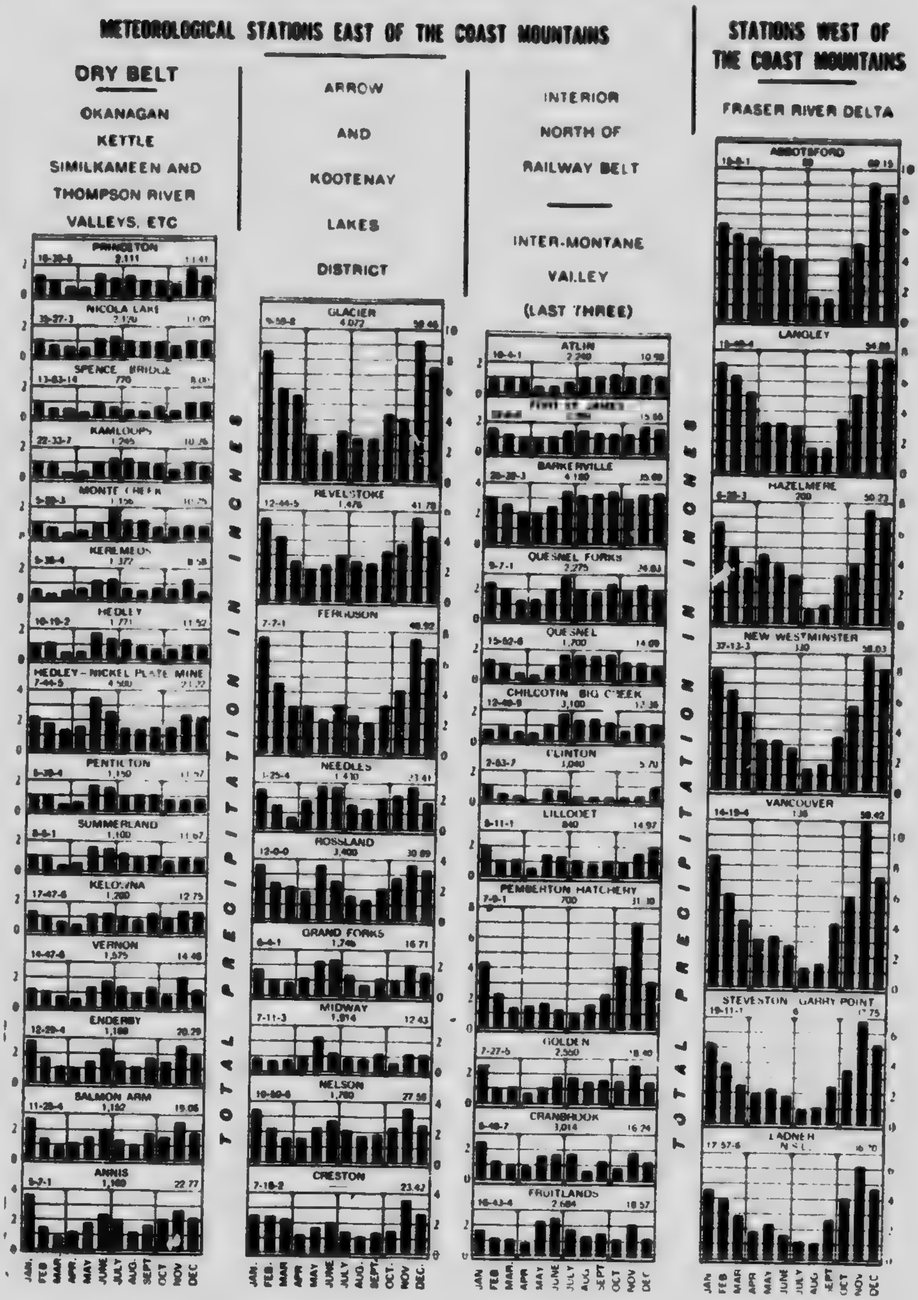
The diagram for Stave river typically illustrates the conditions obtaining on glacial-fed coastal streams. If comparison be made between this diagram and the precipitation diagrams on Plate B, columns 1 and 2, it is apparent that much of the precipitation during January, February and March is stored as snow at the high elevations, and that, with the coming of the warmer months, this stored precipitation is released, thus augmenting the flow until late in the summer. The low water occurs in August. Further north, on the coast, it is probable that the run-off is yet more evenly distributed throughout the year, because, due to the more northerly latitude, the summer flood would 'peak' later in the year, while at the same time the autumn rains start earlier (Plate B, column 3).

Diagrams on Plates H and I illustrate the discharge characteristics of streams on Vancouver island. For these, particularly, it has been necessary to utilize some short records. Those for Stamp, Cowichan and Little Qualicum rivers are each for a period of 3 years and 10 months ; for January and February but 3-year records are available; moreover, a reference to the stream-flow tables will show that, on each of the three streams, the mean discharge for February happened to be practically the same for 2 of the 3 years. Obviously, longer term records are here necessary. Notwithstanding the short records

employed, however, it is possible to perceive certain characteristics, and t note the influence of some modifying factors. The effect, for example, of th autumn and winter rains on run-off is seen on all the diagrams, and, with th exception of Campbell river, it appears that a much smaller proportion of th winter precipitation is stored than in the case of the streams shown o Plate G for the mainland coast. Campbell river drains the most mountain ous part of Vancouver island, and is fed by several glacial streams. It flow, therefore, is maintained until well on in the summer, the peak usuall occurring in June. The three comparatively large lakes on this stream, i their natural state, exercise but little influence on the mean monthly flow they do, however, have a marked effect on the extreme daily maximum an minimum flows.

Conclusion Special emphasis has been given previously in this report t the fact that it is necessary to possess more complete an extensive hydrometric data. This is especially so in British Columbia, owing to the diversified nature of its topography. Where information respecting meteorological and hydrometric data is specifically gathered, it becomes practicable to make intensive studies which will prove an insurance against some of the failures too frequently made in connection with the design o power developments. As an example of information of a comprehensive character being gathered in connection with specific projects, one may consider the data for Lake Buntzen development, for Stave Falls development, and for that proposed by the Couteau Power Co. at Shuswap falls. Some of the data for the latter project are shown on Plate J.

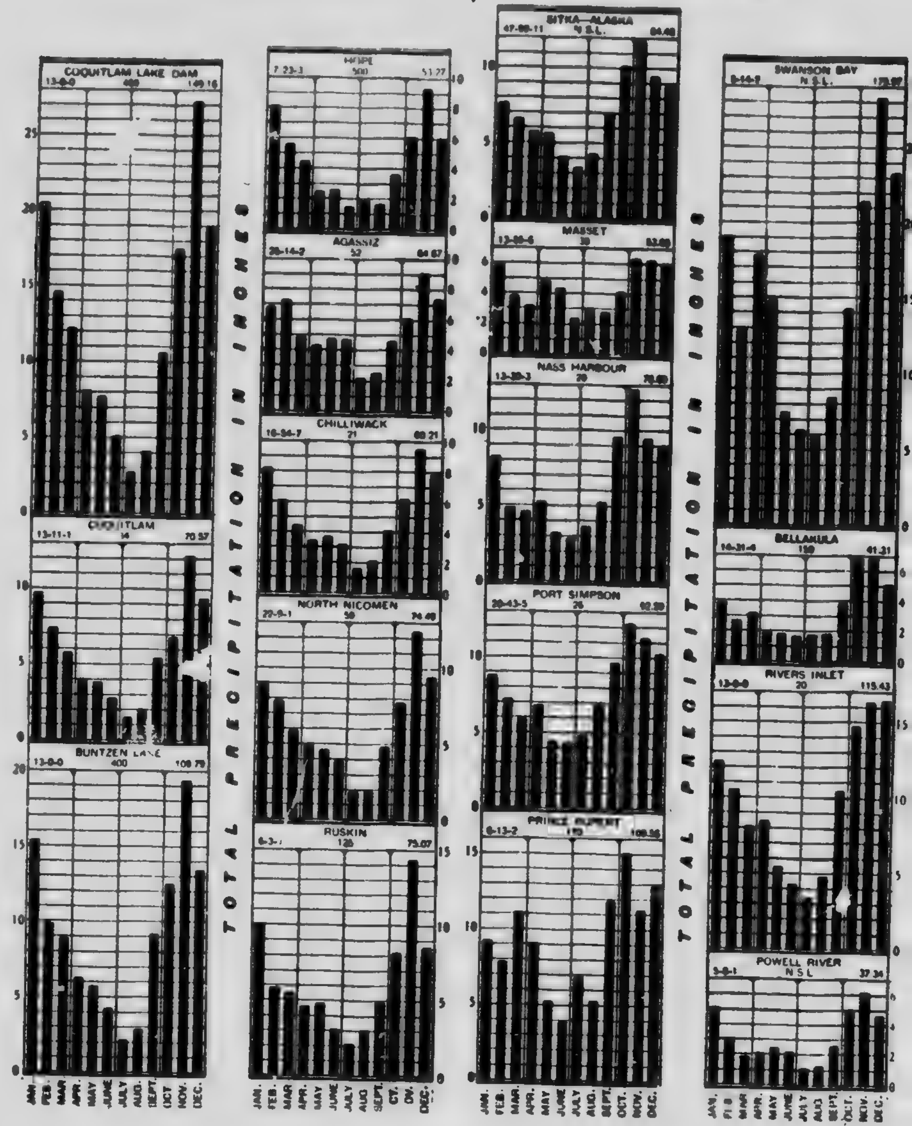
MONTHLY DISTRIBUTION OF PRECIPITATION



MONTHLY DISTRIBUTION OF PRECIPITATION

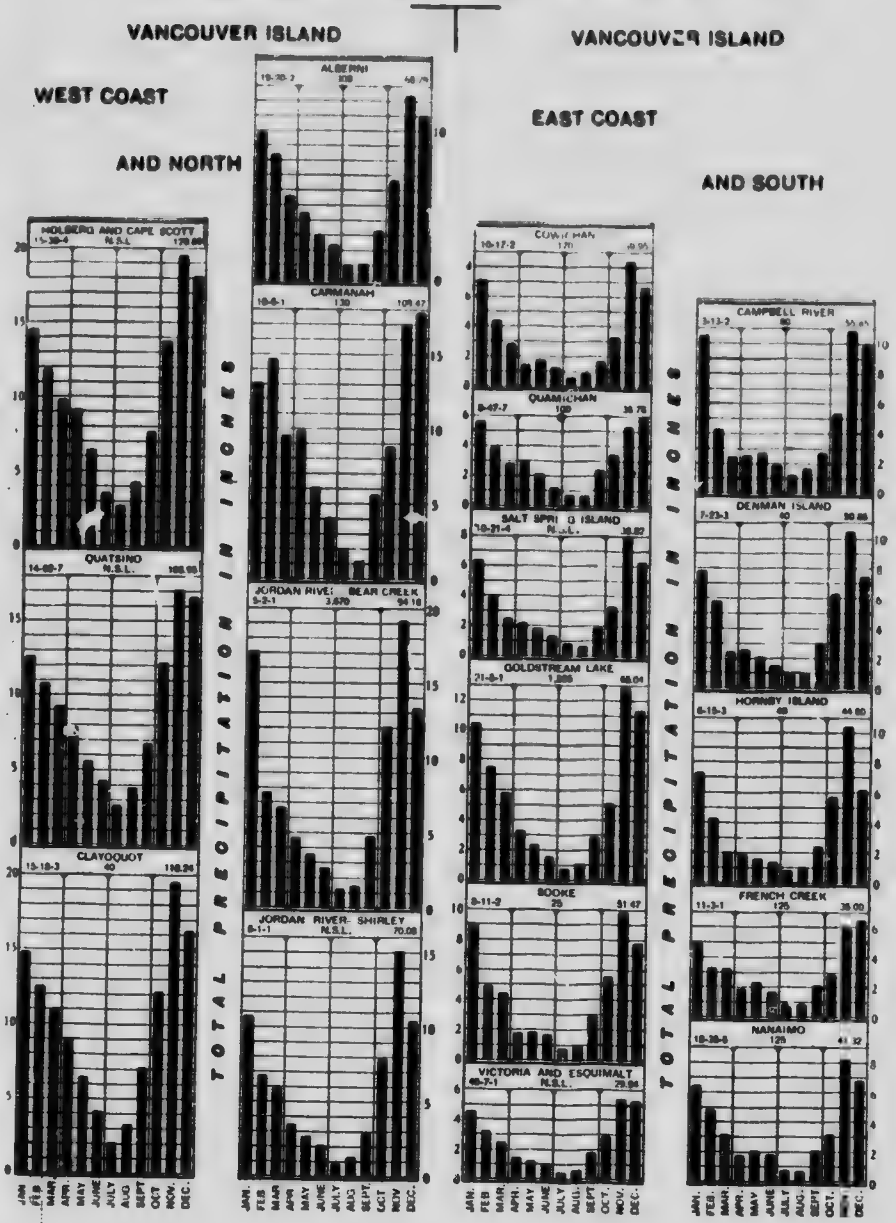
METEOROLOGICAL STATIONS WEST OF THE COAST MOUNTAINS

FRASER RIVER LOWER VALLEY — COAST DISTRICT



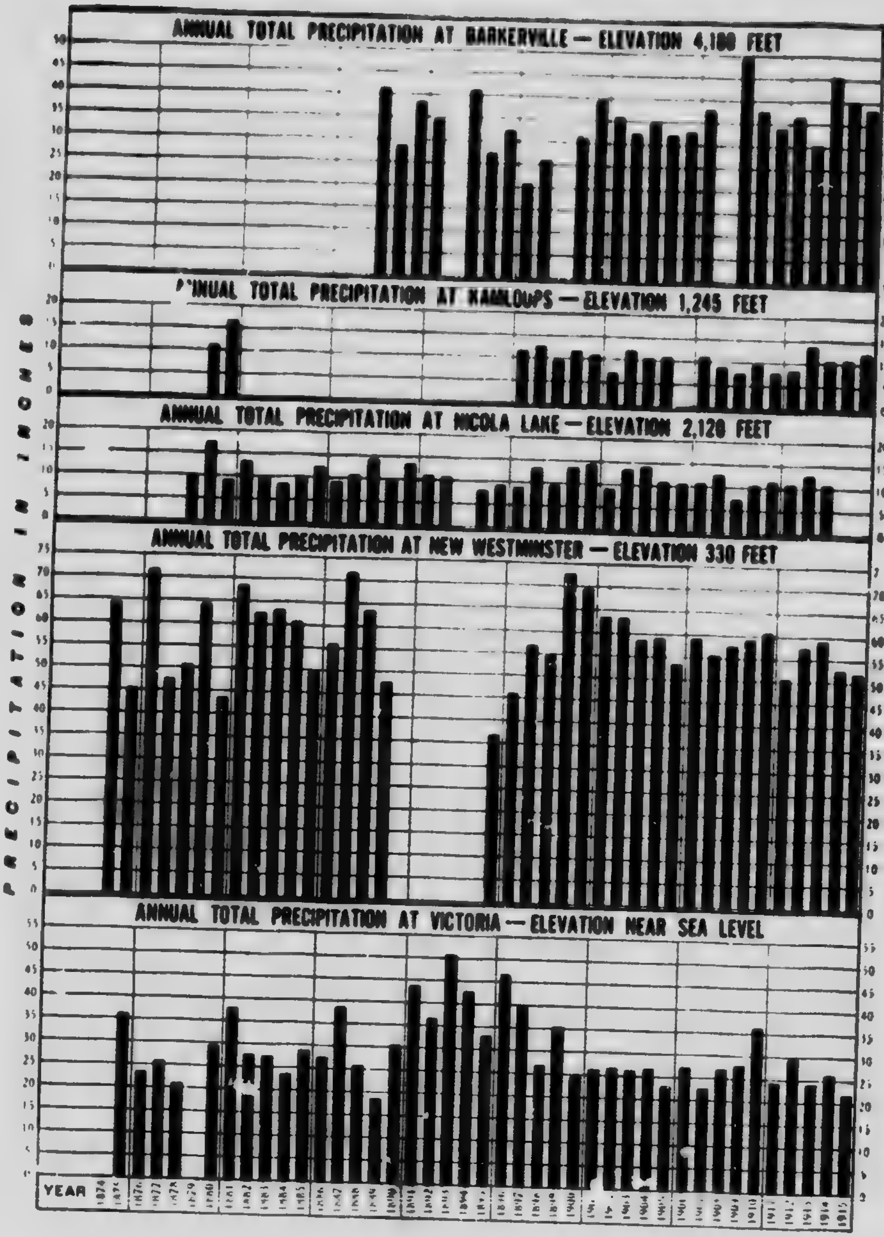
MONTHLY DISTRIBUTION OF PRECIPITATION

METEOROLOGICAL STATIONS WEST OF THE COAST MOUNTAINS



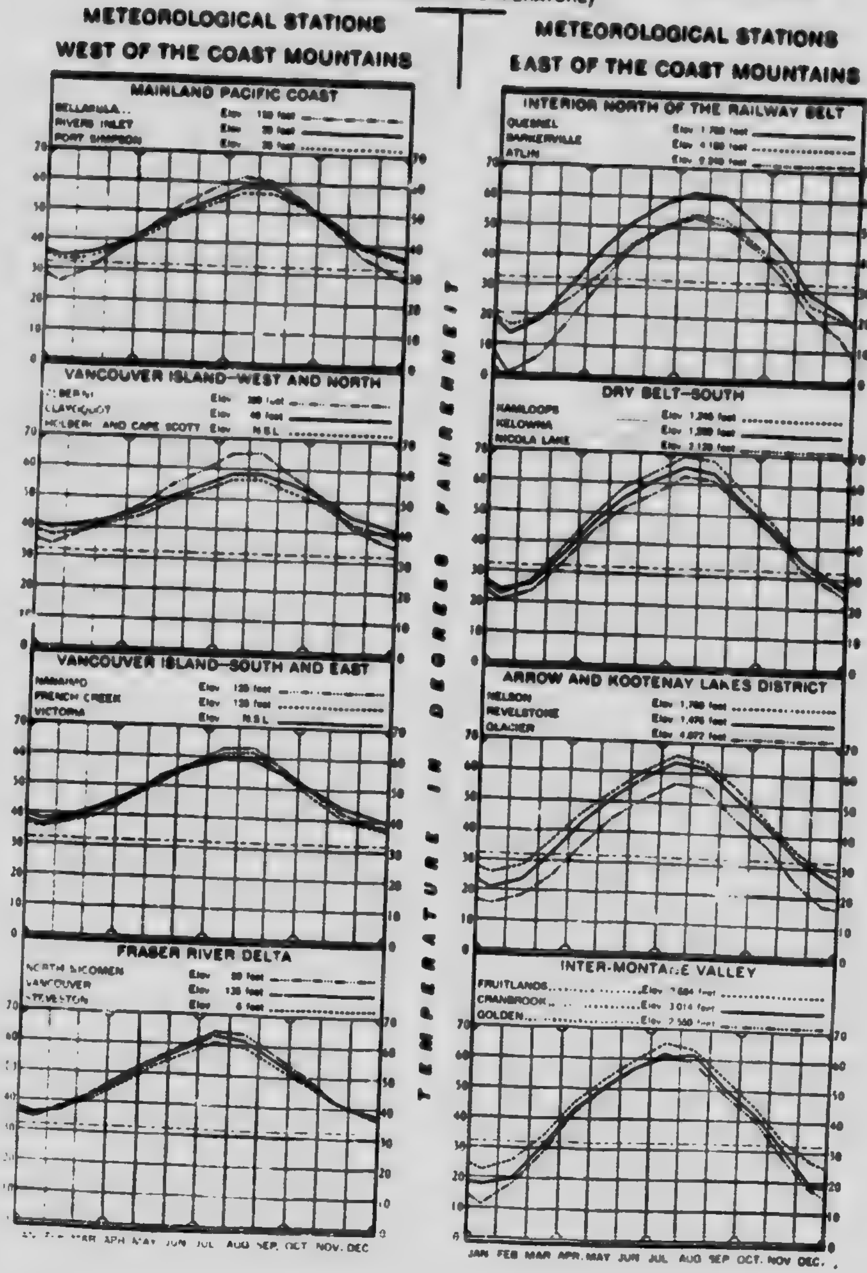
ANNUAL PRECIPITATION

METEOROLOGICAL STATIONS IN BRITISH COLUMBIA



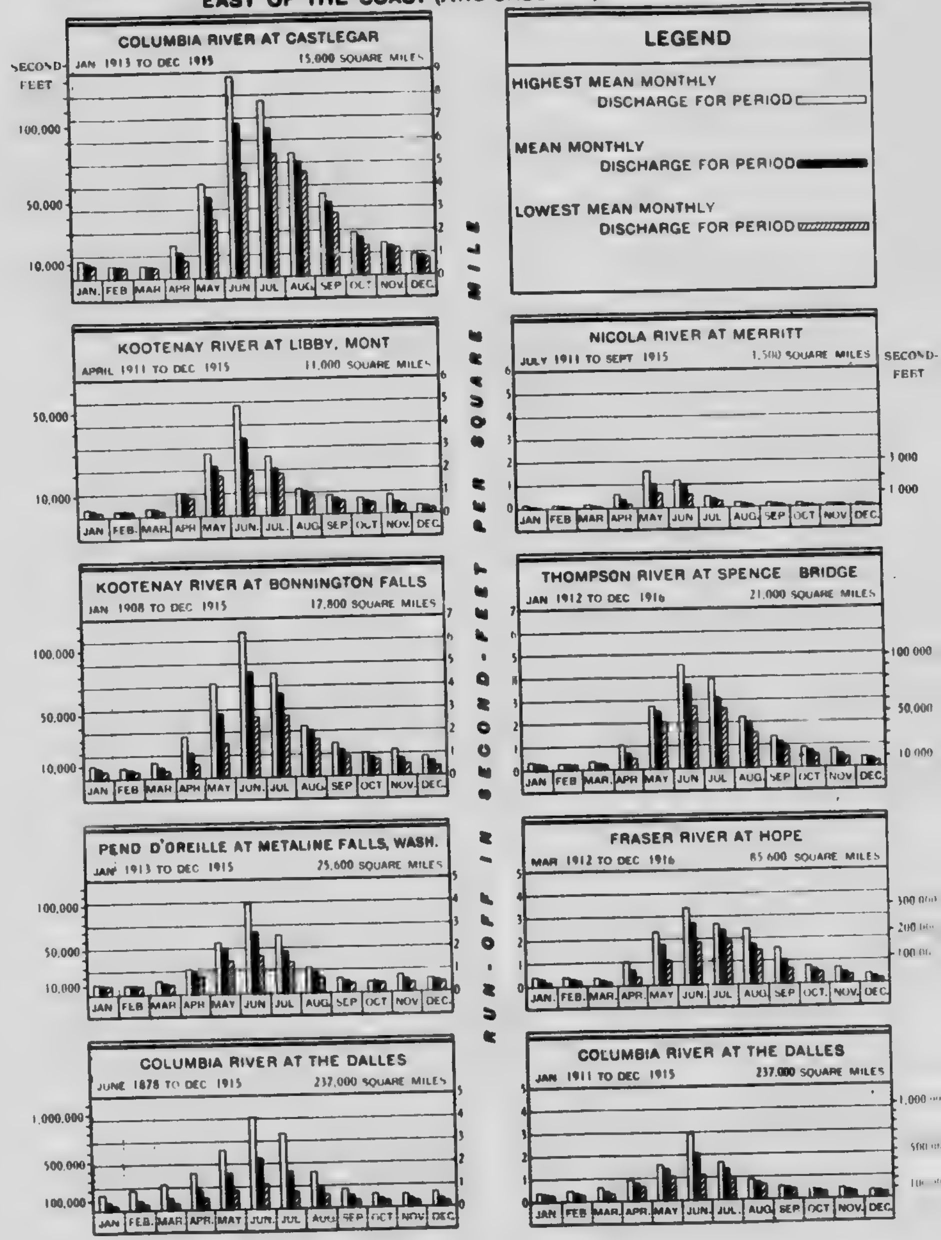
MONTHLY DISTRIBUTION OF TEMPERATURE

(MEAN MONTHLY TEMPERATURE)



MONTHLY DISTRIBUTION OF RUN-OFF

GAUGING STATIONS ON STREAMS WITH DRAINAGE BASINS LYING TO THE EAST OF THE COAST (AND CASCADE) MOUNTAINS



MONTHLY DISTRIBUTION OF RUN-OFF

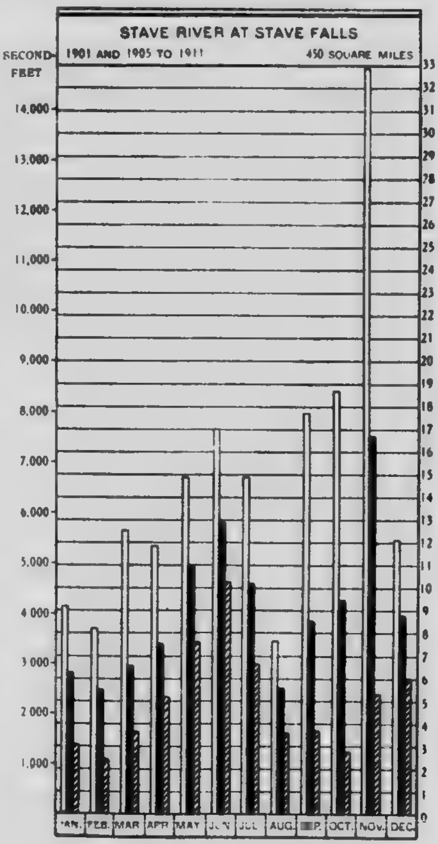
GAUGING STATIONS ON STREAMS WITH DRAINAGE BASINS LYING TO THE WEST OF THE COAST OR CASCADE MOUNTAINS

LEGEND

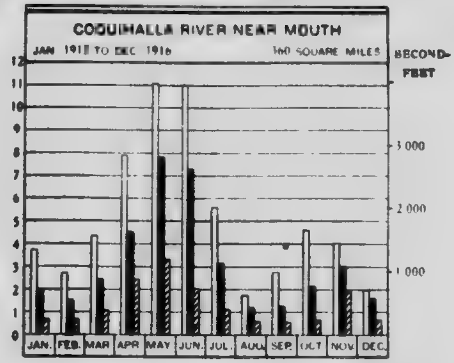
HIGHEST MEAN MONTHLY DISCHARGE FOR PERIOD

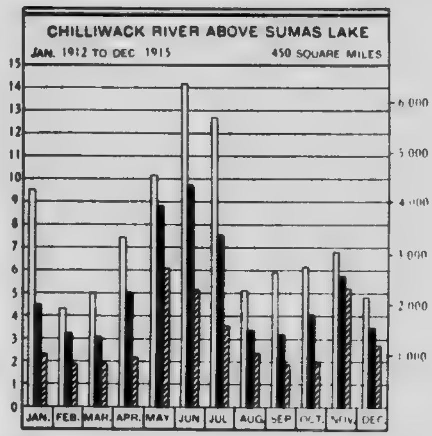
MEAN MONTHLY DISCHARGE FOR PERIOD

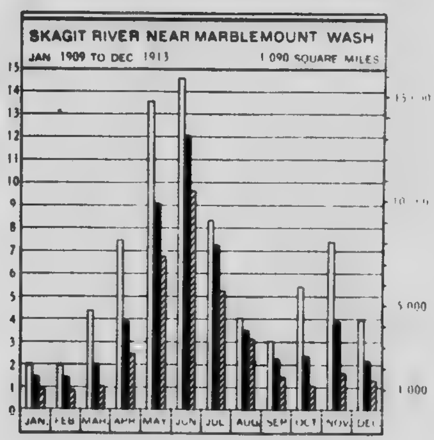
LOWEST MEAN MONTHLY DISCHARGE FOR PERIOD



RUN-OFF IN SECOND-FEET PER SQUARE MILE

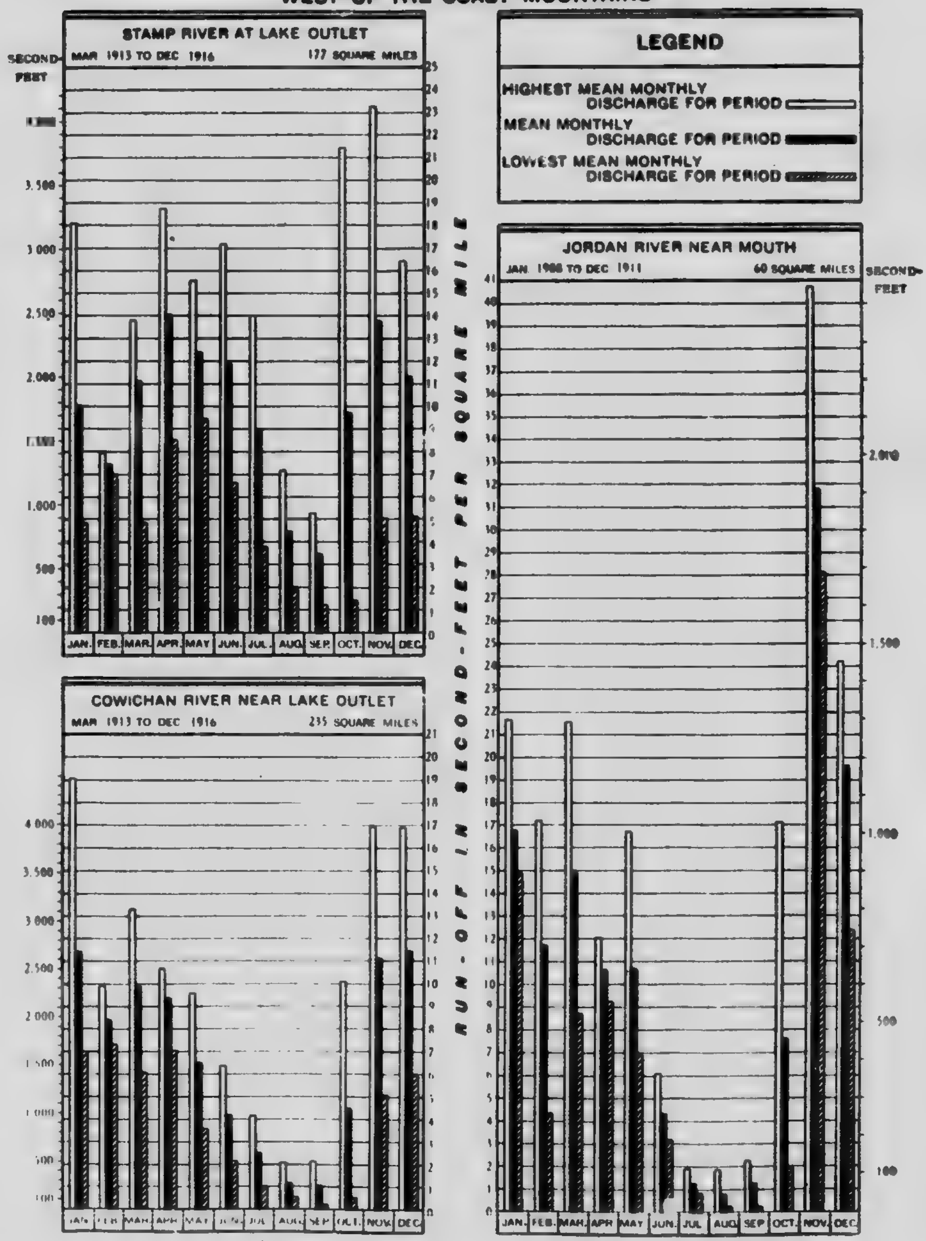






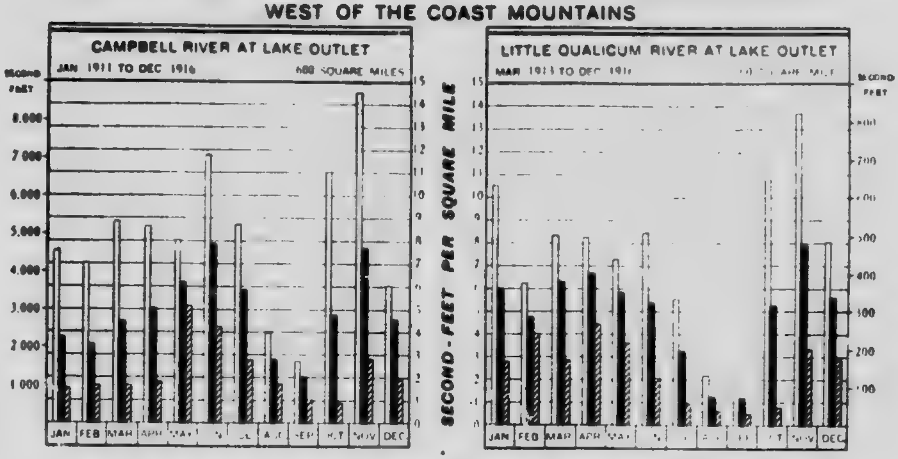
MONTHLY DISTRIBUTION OF RUN-OFF

GAUGING STATIONS ON STREAMS ON VANCOUVER ISLAND, BEING WEST OF THE COAST MOUNTAINS



MONTHLY DISTRIBUTION OF RUN-OFF

GAUGING STATIONS ON STREAMS ON VANCOUVER ISLAND, BEING WEST OF THE COAST MOUNTAINS



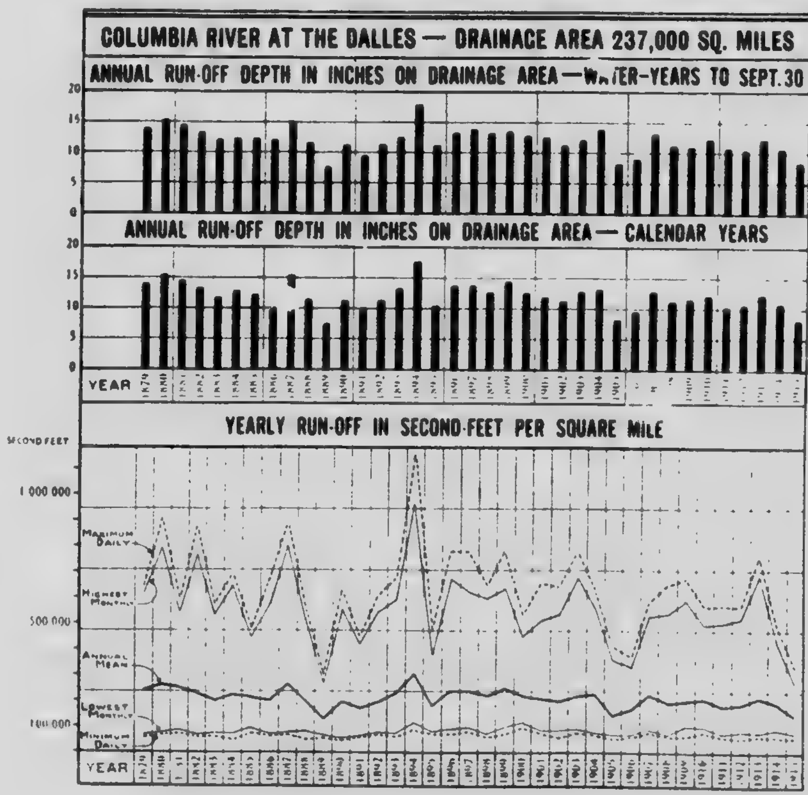
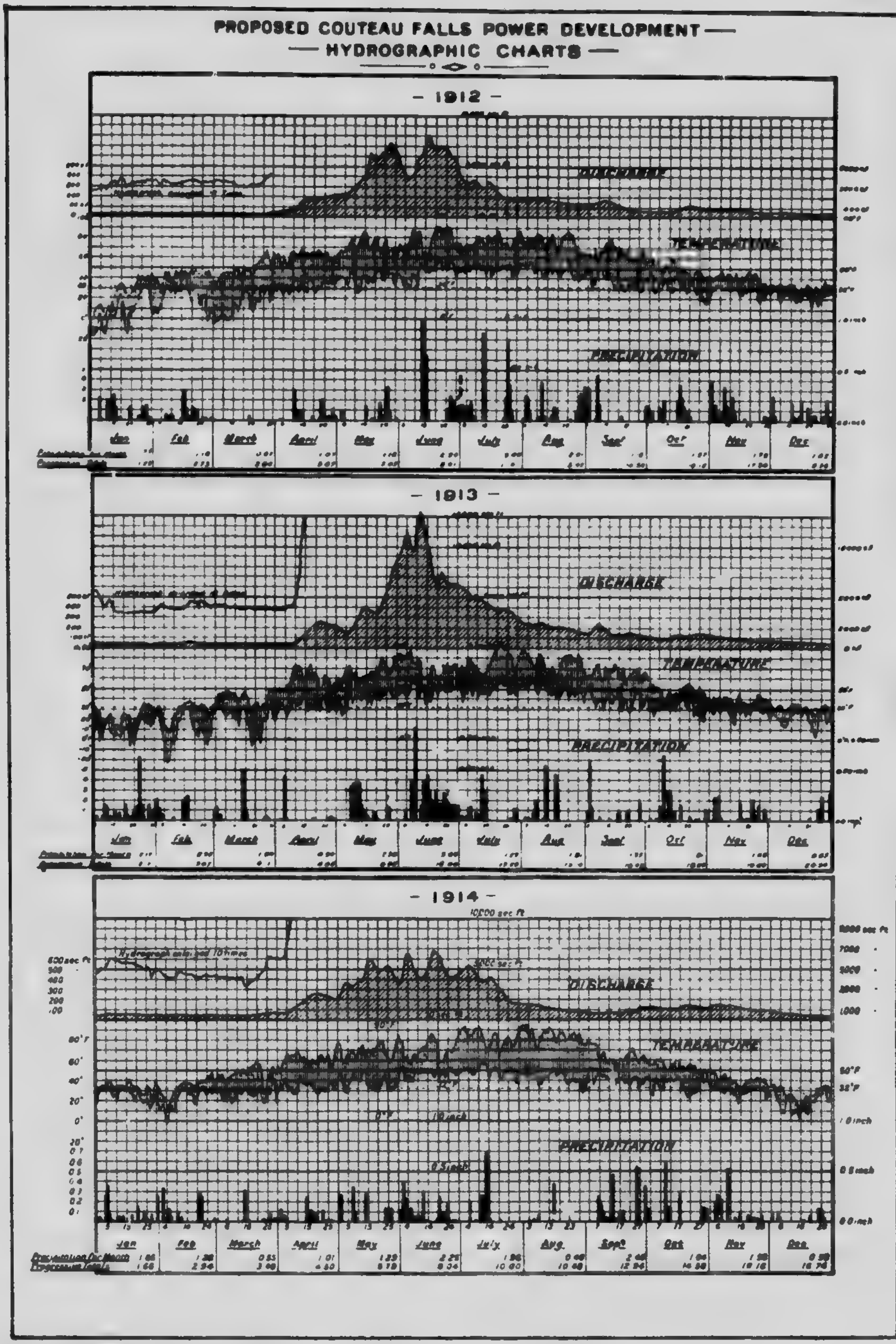


PLATE J



Courtesy Mr. A. R. Mackenzie

CHAPTER XVIII

Meteorological Data

PROBLEMS of hydrology, especially those relating to the conservation of water resources for municipal and domestic water supply, irrigation, power and other purposes, demand that estimates, as nearly accurate as possible, be obtainable of the water run-off available from any watershed that may be under consideration. Such supply originates in precipitation. As a basis for estimating this run-off, meteorological data, such as records of precipitation, temperature, etc., are second in importance only to actual measurements of stream flow.

Precipitation may take the form of rain, snow, hail, dew or, in theory, fog. The amount of any form of precipitation is usually stated in terms of its equivalent depth of rainfall expressed in inches. In selecting a precipitation station special regard must be paid to the manner in which the snow falls in the proposed vicinity. Dry snow may be driven by the wind from the place where it first fell, thereby increasing the apparent precipitation in another locality. Thus, in hilly or mountainous regions, wind-swept slopes and ridges are often robbed of their legitimate quota of the annual snowfall, whereas sheltered slopes, gorges, valleys and cañons derive additions to their supply as received from direct precipitation. From the viewpoint of aerophysics, neither the depleted snowfall on the exposed ridges, nor the excessive fall reposing in the sheltered places, may represent the true precipitation for a particular region. On the other hand, such unequal distribution of snow may be the normal, yearly, recurrent phenomena for a given locality ; hence, from the climatological viewpoint, the snow on the ground, whether derived from direct fall or affected by drift, may be considered as the precipitation of the locality. The securing of true records of snowfall is less interfered with on extensive plains or in broad open valleys.

In view of the foregoing it is clear that precipitation data—which includes snowfall—cannot be satisfactorily studied without taking into account the extent to which snowfall precipitation records may be affected by the exposure and environment of the respective stations where records are secured. In most instances meteorological stations are situated in or near cities, towns or villages. Such communities, in a mountainous country like British Columbia, are usually situated in the valleys and along sheltered slopes ; hence, in general, observations made in these places will tend to show more snowfall than the true amount for the locality. In the case of many stations, however, such readings, even though excessive, may be more than counterbalanced by the greater precipitation falling at higher altitudes. In practice, snowfall is measured as actually found at a station, irrespective of its source.

The causes of precipitation are varied and complex. In many cases they are directly connected with great cyclonic disturbances, while in other in-

stances they result from more local circumstances and are largely influenced by the immediate topographic features. Mountains are one of the chief causes of unequal distribution. It is not uncommon to find precipitation occurring on one side of a valley, while the opposite slopes are receiving none, and, even in a territory with no very marked topographic features, local variations are frequently experienced. Such variations in records taken over long periods will probably be found largely to counterbalance each other.

Securing Accurate Records

In order to lessen the effects which local variations may have upon the uses to which the data are applied, it is desirable to have a large number of properly distributed stations. The number for any district depends largely upon geographical and topographical features. On the Great plains, where there are no marked differences of elevation, a relatively small number of widely separated stations may suffice, but in a mountainous country, like British Columbia, many stations, often in close proximity, are required.

As a general rule, for any district where a complete set of meteorological observations from one station would give a true representation of meteorological phenomena apart from precipitation, measurements to furnish a record of equal value for the precipitation would be required at many more stations, say, thirty or more.

Respecting the length of time required to secure a true mean precipitation record, Sir Alexander R. Binney, in his discussion on 'The Variation of Rainfall',* has stated that the mean derived from 35 years of good records will probably differ by 1·79 per cent from the true mean for a long period of years; the 20-year mean will probably vary 3·27 per cent from the true mean; the 15-year mean, 4·77 per cent; the 10-year mean, 8·22 per cent; and the 5-year mean will probably differ by 14·93 per cent from the true mean. These results are based on data from 26 stations distributed over a large portion of the earth, with records of an average length of 53 years.

Mr. Alfred I. Henry, in his 'Rainfall of the United States',† writes that the average variation of a 25-year mean is about 5 per cent, and of a 40-year mean about 3 per cent, from the true mean.

In the investigation recently conducted by the International Joint Commission, the precipitation records for the Lake of the Woods watershed were subjected to careful analysis. In the report to the Commission by the consulting engineers, attention is drawn to the long-term records at Duluth, Minn., Winnipeg, Man., and Pembina, N.D., and it is stated that:

"The mean precipitation at Duluth, from 1871 to 1913, is 29·42 inches, while the mean from 1885 to 1913 is 27·21 inches, a variation of the 29-year mean from the 43-year mean of 2·21 inches, or 7·5 per cent. The mean precipitation at Winnipeg, from 1873 to 1913, is 21·41 inches, while the mean from 1885 to 1913 is 20·17 inches, a variation of the 29-year mean from the 41-year mean of 1·24 inches, or 5·9 per cent. The mean precipitation at Pembina, from 1872 to 1913, is 19·36 inches, while the mean from 1885 to

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* *Proceedings of the Institute of Civil Engineers*, Vol. 109, p. 131.

† *Report of the Chief of the Weather Bureau*, Washington, D.C., 1896-7, p. 317.

1913 is 18·87 inches, a variation of the 29-year mean from the 40-year mean of 0·49 inches or 2·5 per cent." *

East of the Coast mountains in British Columbia, the prevailing temperature in the winter months is such that nearly all the precipitation falls as snow, and, in the province generally, there are extensive areas at high altitudes where most of the precipitation, at any time of the year, is snowfall. Much of this melts during the spring, but, of that which falls at the higher altitudes, some remains till late in the summer. At still higher altitudes heavy winter snowfall frequently furnishes a residue which may be carried over for one or more seasons, while on the summits of the highest ridges glaciers and perpetual snowfields constitute huge reservoirs, the melting of which materially augments the run-off during the summer months.

The amount of run-off derivable from snow storage is of special importance in British Columbia. It augments the water available for irrigation, power and other purposes ; and it is highly desirable that the fullest possible data respecting rainfall, snowfall, snow storage, temperature, evaporation,† etc., be collected.

The following are a few of the principal factors involved in the collection and interpretation of meteorological data :

Rainfall Records The measurement of rainfall is not a difficult matter. The usual form of rain-gauge is, when properly installed in a favourable situation, quite satisfactory.

The gauge supplied by the Canadian Meteorological Service is illustrated on Plate 35. The rain enters the small receiver D, through the small tube projecting from the funnel of upper part E. Usually once a day, in the morning, part E is removed, and the contents of D, if any, are transferred to the measuring glass F. As the mouth has an area of 10 square inches, the volume in cubic inches of water collected, divided by ten, equals the rainfall in inches. An advantage of using this gauge is that, should the measuring glass be lost or broken, any means of determining the volume in cubic inches will measure the rainfall.

The large receiver C collects any overflow from D, which holds about 13·5 cubic inches, equivalent to 1·35 inches of rainfall. It also divides the rain-

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* *Report to International Joint Commission Relating to Official Reference re Lake of the Woods Levels, 1915*, by Arthur V. White and Adolph F. Meyer, p. 61 ; see *Ibid*, pp. 58-82.

† Respec evaporation and cognate data, see United States Weather Bureau, Instrument Division, publications, Washington, D.C.: *Instructions for the Installation and Operation of Class A Evaporation Stations*, by B. C. Kadel, Circular L, 1915, illus. ; also *Instructions for Operating the Hydrograph and Tabulating Records Therefrom*, by C. F. Marvin, Appendix to Circular A, 1911 ; also *Instructions for the Installation and Maintenance of Wind Measuring and Recording Apparatus*, Circular D, 1914, illus.; *Barometers and the Measurement of Atmospheric Pressure*, by C. F. Marvin, Circular F, 1912, illus.; *Instructions for the Care and Management of Electrical Sunshine Recorders*, Circular G, 1914, illus.; see also 'The Winds of the United States and Their Economic Uses,' by P. C. Day, in *Year Book of Department of Agriculture*, 1911, pp. 337-350. Consult further, 'Description of Evaporation Station maintained by Dominion Water Power Branch on Lake of the Woods at Kenora, Ontario,' *Water Resources Paper No. 3*, pp. 57 *et seq.*; also 'Computing Run-off from Rainfall and other Physical Data,' by A. F. Meyer, in *Proceedings of the American Society of Civil Engineers*, March, 1915 ; also 'Evaporation Records,' published in *Report of Consulting Engineers, International Joint Commission, Lake of the Woods Investigation*, 1915.

gauge into a series of air chambers which minimize loss from evaporation. The large receiver C holds the equivalent of 5 inches of rainfall.

The United States Weather Bureau standard gauge is 8 inches in diameter, and has an inner copper receptacle twenty inches high with a cross section one-tenth that of the mouth of the rain-gauge. The depth of water in the inner receptacle is ten times the rainfall, and is measured with a stick graduated to read the actual rainfall to hundredths of an inch.

Next to the selection of the observing station is the problem of so exposing the gauge that it will collect a truly representative sample of the rainfall. Where possible, the selected position should be in some open space, unobstructed by large trees or buildings. Low bushes, fences or walls in the vicinity of the gauge are beneficial, but must be situated from the gauge a distance of not less than their height.

Wind is the chief cause of inaccuracy in records. Its effects must be guarded against by providing some form of wind shield. It has been demonstrated that the quantity of rainfall in unprotected gauges is always deficient and large variations may occur where gauges are exposed to marked wind action. The United States Weather Bureau bulletin on the *Measurement o Precipitation* states that :

"Within a few yards of each other two gauges may show a difference o 20 per cent in the rainfall in a heavy rain storm. The stronger the wind, th greater the difference is apt to be. In a high location, eddies of wind pro duced by walls of buildings divert rain that would otherwise fall in the gaug A gauge near the edge of the roof, on the windward side of a building, shows le rainfall than one in the centre of the roof. The vertical ascending curre along the side of the wall extends slightly above the level of the roof, and pa of the rain is carried away from the gauge. In the centre of a large, flat roo at least 60 feet square, the rainfall collected by a gauge does not differ mate ially from that collected at the level of the ground. A gauge on a plane with tight board fence 3 feet high around it at a distance of 3 feet will collect 6 p cent more rain than if there were no fence. These differences are due entirely wind currents."

One of the most satisfactory forms of wind-shield is that used by Niphe who, in 1878, demonstrated that an ordinary rain-gauge would collect almo or quite the true catch of rainfall if surrounded by a trumpet-shaped sheet metal, terminated in an annular rim of copper wire-gauze, 20 gauge, me 8 wires to the inch, to prevent in-splashing. This device so far minimiz the wind effect that one of these gauges, 118 feet above the ground, collect the same amount of rainfall as a shielded gauge on the ground.

Satisfactory results have been obtained by the use of some form of win break around the top of the gauge. This should be placed about 8 to 12 inch away from the gauge and its top edge should be a few inches higher than t rim of the gauge, say, at an angular elevation of 20 to 30 degrees above it.

Snowfall Records It is less easy to measure snowfall than rainfall. The ch reason is the difficulty, due to wind effects, experienced collecting a representative sample of a fall of snow. In Canada and the Unit States, therefore, it is the usual practice to require observers to measure snow upon the ground.

A B C D E F

STANDARD RAIN GAUGE OF THE CANADIAN METEOROLOGICAL SERVICE

A. Assembled Rain-Gauge. Diameter of base 5 inches, height 10 inches, area of mouth 10 square inches. B. Outer stand. C. Large receiver (copper). D. Small receiver (copper). E. Upper part of gauge (brass) which fits over the outer stand, the small tube which projects from the funnel extends, when the apparatus is assembled, into the mouth of the small receiver. F. Measuring glass, graduated to read in cubic inches, each cubic inch corresponding to one-tenth of an inch of rain-fall.

Careful measurement by experienced observers of the depth in favourable situations is probably the most satisfactory method of determining the snowfall, and the results of such measurements constitute the criterion for comparing the accuracy of special snow collecting apparatus. Unfortunately, suitable places are not always found close to the observing station, yet, even on windy days, beds of snow of uniform depth may be found in sheltered spots, for example, in small clearings in woods. The depth recorded should preferably be the mean of measurements taken at several selected spots where experienced judgment indicates that a normal and representative depth is to be found.

A simple device sometimes employed to facilitate the measurement of newly-fallen snow is the 'snow-mat.'* This mat, made of white duck, serves as a base for the first fall or, when placed on the surface of snow already fallen, serves as a dividing plane for the next fall.

There are many cases when ground measurements fail to represent accurately the fall of snow ; for example, when snow and rain are mixed or alternate, when melting takes place, or when the fall is very light. It is desirable, therefore, to employ some form of collector which can be relied upon to secure representative samples even under unfavourable and widely variant conditions. Various devices have been employed to reduce the great disturbances due to wind, but without full success. M. Billwiller's observations, as reported in *Meteorological Zeitschrift*, May, 1910, are of interest. On account of high winds on the Gotthard in the Alps, satisfactory rainfall and snowfall measurements had not been secured. He employed a shielded gauge, resembling somewhat the Nipher design. In light winds, the catch of snow was fifty per cent greater than that caught in the ordinary gauge and, with high winds, about 100 per cent greater. That is, the shielded gauge collected twice as much snow as an ordinary unshielded gauge.

No single design of collector is uniformly applicable for all conditions. The U. S. Weather Bureau has conducted experiments to determine the best form of snow-gauge † and has also sought to devise some form of seasonal gauge, for use in out-of-the-way places, and which would only be visited by an observer at infrequent intervals, perhaps only at the beginning and end of the winter.

A snowfall-gauge must be elevated some distance above the ground, in order to escape surface drifting and to be above the accumulated depth of

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* This simple device consists of a piece of white duck, about twenty-eight inches square, with small, triangular pockets at each corner to receive diagonal slats of wood, which maintain the mat taut and flat. Short pegs projecting downward from the slats prevent displacement by the wind, and the possible loss of the mat in a storm may be guarded against by attaching to it a stout cord fastened to a stake a few yards distant. When snow is on the ground, the mat is simply laid on the snow surface ; its lightness permits the soft snow to support it practically even with the surface of the former fall ; its colour being white tends to lessen the chance of a partial melting. In ascertaining the amount of the fall, a small area is cleared and the depth measured.

† For further description of meteorological apparatus, including snow-gauges, consult publications mentioned in footnotes to this chapter. The U. S. Weather Bureau has conducted interesting experiments relating to meteorological data in Washington, Idaho and Montana. The northern portions of these states border southern British Columbia and, having characteristics of topography in common, records and experiments on either side of the boundary are of value to each country.

snow. This elevation, which, in some cases, may amount to twenty or thirty feet,* increases the liability to inaccuracies due to wind effects and makes it essential to provide a wind-shield.

The collection of snowfall is not infrequently accomplished by using the lower portion of the standard rain-gauge. It is customary, where a special gauge of this type is installed for snow collection, to employ one of larger diameter than is used for rain. Where there is no wind and the snow is saturated, or alternates with rain, this is a fairly satisfactory method. Where there is wind, even in these gauges some form of shield must be employed.

Special snowfall-gauges, or collectors, are usually supported on an elevated structure fitted with a suitable permanent wind-shield. The shielded rain and snow gauge designed by C. F. Marvin, Chief of the U. S. Weather Bureau, admits of considerable latitude in construction and details of design. It has a Nipher trumpet-shaped wind-shield, whose extreme diameter may be not less than three and not more than four times the diameter of the receiver. The mouth of the receiver should be at a slightly lower elevation than the extreme edge of the Nipher shield, so that the edge of the shield if it could be viewed from the edge of the receiver, would have an angular elevation of possibly 5 to 10 degrees. As the receiver is 40 inches deep by 10·85 inches inside diameter, its capacity is adequate to contain any snowfall likely to occur at most stations between regular hours of observation. The size may, of course, be increased where special conditions so require. The following description of the wind-shields employed is taken from the instructions on the measurement of precipitation issued by the United States Weather Bureau :

"A double arrangement of wind-shields surrounds the mouth of the gauge. On the outside is a large Nipher trumpet-shaped shield of galvanized sheet iron arranged in octagonal form to simplify construction, and to reduce cost. Inside the trumpet shield is a fence-shield, consisting of four sheets of iron, 12 inches wide, spanning the space between the corner posts. The upper edges of the [inner] shields stand above the rim of the gauge by from twenty to thirty degrees angular measure.

"At the top the collector is centred and secured in place by a guard ring carried on the supports. At the bottom the can rests upon a central support, which can be raised and lowered for placing and removing the collector."

In measuring snowfall the collector, with its contents, is weighed on a balance adjusted to read zero when the collector is empty. The scale is graduated to give the rainfall equivalent, in hundredths of an inch, of any collected precipitation. Where not practicable to adjust the balance to read zero with the empty collector, due allowance must be made.† (See plate 36 for diagram of shielded snow-gauge.)

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* Consult 'The Region of Greatest Snowfall in the United States,' in *Monthly Weather Review*, May, 1915, 43, pp. 217-221, Washington, D.C.

† Other apparatus, including a design for a shielded seasonal snow-gauge, are illustrated and discussed in *Measurement of Precipitation*, by C. F. Marvin, Circular E, Instrument Division, Washington, D.C., 1913. See also in United States *Monthly Weather Review*, May, 1915, 43, pp. 217-221, article by Andrew H. Palmer, 'The Region of Greatest Snowfall in the United States.' Figure 11 shows a Marvin sheltered gauge in operation at Blue Cañon, Cal.; also, note references to experimental researches of Mr. B. C. Kadel ; also comment, page 218, respecting accumulation of snow on shielded gauge in manner to affect recorded 'catch.'

Rainfall Equivalent of Snowfall

When the depth of snowfall has been measured, or a representative sample secured, it becomes necessary to ascertain its equivalent depth in rainfall.

When the snow is collected in the usual rain-gauge, it may be melted either by putting it in a warm place, or, better, by adding a known volume of warm water. The liquid is then measured in the usual way.

In Canada and in the United States, ten inches of snow is usually considered as equivalent to one inch of rain. While convenient, this method does not yield precise results, on account of the varying density of the snow.

Some experiments carried out by Mr. A. J. Connor, of the Canadian Meteorological Service, Toronto, show that the amount of snow required to give one inch of water varied between 6 and 16 inches. No definite relation was found between the density of the snow and the surface conditions of temperature, pressure, etc. Doubtless, the results from such experiments will vary somewhat in different localities; and the snow which falls on the Pacific coast will be found to be, on an average, heavier and more saturated than that in the interior.

These conclusions are substantiated by the observations of the section directors of the U. S. Weather Bureau, in Washington, Idaho and Montana, which show that the water equivalent of snow may vary from 1 to 8 to 1 to 18.

The Washington director states : "Very moist snow, although freshly fallen, may have a water equivalent of 1 to 8, whereas very dry snow may have the equivalent of only 1 to 18." He considers that the ratio of 1 to 10 for ordinary dry snow, freshly fallen, is too high ; that, as an average, it yields results approximately correct and, although it gives, in some instances, too great a water value, it may serve to compensate for the deficient catch that is necessarily due to defects of gauge construction, exposure, wind eddies, etc.

The director for Idaho states that, though using the common co-efficient of 10, nevertheless "In actual experience, however, we have found it to range all the way from less than one-half this amount to an amount somewhat greater. The average will probably be not far from 0·08 of an inch of water for an inch of snow."

The director for Montana states that "The experience at this station is that the relation between snow depth and water equivalent is about 15 to 1. It is thought, however, this varies here in the mountains even more than in a humid climate, and for that reason we endeavour to get, as far as possible, the actual result from melting the snow catch and measuring as water."

The general conclusions, based on numerous experiments, indicate that the variations range from one inch of water for six or seven inches of heavy snow, to one inch for fifteen or twenty inches of lighter snow, and occasionally for even thirty inches of very light snow.

Obviously, the same weight cannot be given to precipitation records which include snowfall reduced to a rainfall equivalent on the standard ratio of 10 to 1, as can be given to records from stations where a given quantity of snow depth has been collected and the water equivalent actually found, or

where the density condition of the snowfalls is taken into account. In studies where precipitation records are involved, and where the records from some stations are being weighted with respect to others, special consideration must be given to the snowfall records.

The definite method of finding the rainfall equivalent of a fall of snow, is to obtain a representative sample of the snow, say, by cutting out a section with a cylinder of the same area as the rain-gauge, and melting it. The rain-gauge and the cylinder having the same area, the melted snow, when transferred to the graduated tube used for measuring the rainfall, would show the correct water equivalent.

Another method and, where the apparatus is available, one of the simplest, is to cut out a sample section with a cylinder as above described and weigh it. The balance may be graduated to read the rainfall equivalent. In measuring snow by this method the snow-mat, previously described, greatly facilitates obtaining a representative sample. In taking the sample, the cylinder would be pressed vertically down through the snow to the snow-mat, the sample of snow thus obtained being lifted up and transferred to the balance.

To determine the density and water equivalent of snow accumulated on the ground, where the depths are not excessive, one of the best and simplest contrivances is that devised by Mr. B. C. Kadel, of the U. S. Weather Bureau. This apparatus is described in the U. S. *Monthly Weather Review* for May, 1915, as follows: "For the purpose of obtaining samples of snow, tubes of No. 16 gauge galvanized iron, with an inside diameter of 5·94 inches, which gives the relation 1 pound of snow equals 1 inch of water, were used. Each tube consists of a 2-foot section and a 3-foot section, with a notched collar attached to the 2-foot section in such fashion that both tubes may be joined together. When a sample is desired, the tube is set down rather forcibly into the snow, so that the lower end rests on the ground. A specially designed auger is then screwed down through the imprisoned snow to the bottom, when a pin that passes through a hole in the auger handle rests on the top rim of the tube. The whole is then withdrawn by lifting the tube, the weight of the auger and the snow sample being supported by the cross pin. The snow is then emptied into a pail and weighed on a spring balance." With this apparatus it is possible to secure an unbroken sample of the snowfall, even when the snow is loose and granular in structure.

Snow Surveys We have drawn attention to the marked influence exerted by snow storage upon run-off. It is desirable, especially for irrigation purposes, to possess data upon which some estimate of the probable run-off, for even a few months in advance of its occurrence, may be based. On many of the smaller streams the total available run-off is utilized for irrigation every year; consequently, to the irrigation farmer situated on such streams, the question of how much water he will have in any season is a very pertinent one. If the supply be plentiful, he may place a larger acreage

under cultivation, or plant crops requiring more water; if deficient, he must modify his plans accordingly.

An accurate knowledge of snow storage may not be of the same importance to water-power developments, yet, in particular instances, it may be of prime bearing. Speaking generally, such knowledge is of undoubted value. Where run-off data cover only a short period, a knowledge of snow storage conditions will assist in indicating whether the run-off observed in a given season is normal, is high or is low.

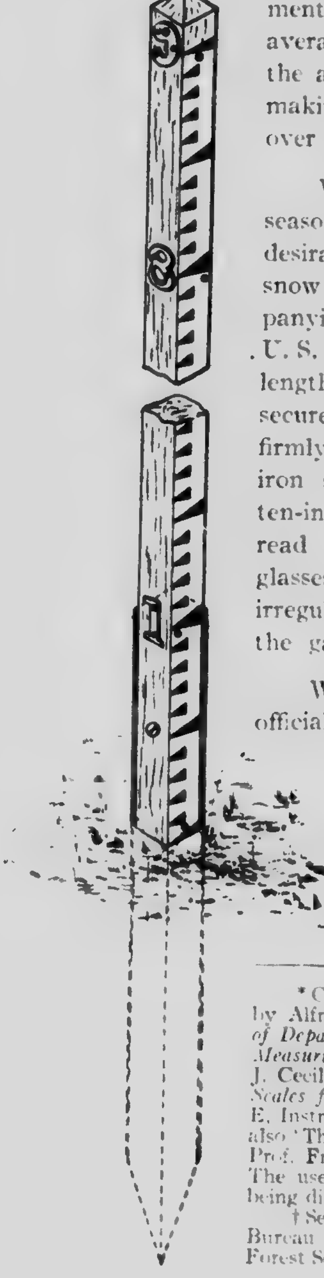
For the most part it is impracticable to determine the winter snowfall on the higher portions of mountainous watersheds. Such areas are difficult of access, repeated journeys thereto are costly, few people live in the mountains in winter, and the apparatus for automatically measuring snowfall is perhaps not sufficiently perfected to encourage its installation. Even were there data available, as gathered by such apparatus, they would not necessarily enable computations to be made to determine accurately the water supply that might be counted upon for the ensuing summer, because, for example, even in winter the stored supply may be depleted by thaws.

The best way to determine the amount of snow that may augment the summer flow is to make a 'snow survey', that is, to measure the snow layer which remains on the ground just before general melting begins. The snow will be found in patches of varying depths and areas. The snow-covered areas are mapped, the depths measured, the volume computed, and, after ascertaining the respective densities, the water equivalent of the stored snow is estimated. Part of the snowfall of one winter may be carried forward to the following or succeeding years. Where this takes place, it would be necessary to make a survey at the beginning of the winter, that the residuum carried forward might be taken into account. Where glaciers exist, information respecting them should also be secured.

From the exposure and nature of drifts—governed chiefly by the topography—some idea may be formed of the probable characteristics of the melting. Snowfields and glaciers with southern exposure may augment stream-flow in the winter, while those with a northern exposure will melt less readily and, thus, assist to keep up the run-off during summer months. As more stream-flow records become available, the effect on run-off of contributions from the melting snowfields will become better known. Manifestly the run-off from snow storage, and its seasonal distribution, are intimately connected with temperature. The whole subject is an interesting one and opens up a field for extensive and profitable research.

A paper on 'The Value of Snow Surveys as Related to Irrigation Projects,' by Mr. Alfred Thiesson, illustrates the character of the information made available as a result of snow surveys. It describes a survey on a watershed of about 6,880 acres, of which about 4,000 acres were under snow. About 2,000

soundings were made with the alpenstock, and the depth and density we measured with specially designed apparatus at 277 carefully selected repr sentative places. This was an average of one density measu ment for every fourteen acres. The survey shows that t average of the 277 depth measurements was 36 inches, a the average water equivalent was 11·5 inches, or 32 per cen making 3,833 acre-feet of water, or the equivalent of fourteen inch over all the ground irrigated under the stream.*



Where the results obtainable would seem to wa··ant ther seasonal snow-gauges might be installed. Where, however, it desirable to make frequent measurements of the accumulati snow on the ground, snow-stakes should be used. The accor panying illustration shows the snow-stake recommended by t U. S. Weather Bureau. It is 1¾ inches square, with a standa length of 90 inches. The stake, which is painted white, securely bolted to galvanized angle steel which has first bee firmly driven into the ground. To it is attached an enamelle iron scale, graduated in inches, with figures opposite eve ten-inch interval; when suitably located, the scale may l read at a considerable distance with a telescope or fiel glasses. In reading due allowance is made for any sligh irregularities in the snow surface in the immediate vicinity the gauge.

Where observations are to be made respecting snowfal officials of the Dominion and Provincial Forest Services coul render great assistance.†

Precipitation and Temperature Records Recognizing the importance of meteorolog cal data in relation to water-powers, thi report contains summaries of all know available precipitation data for British Columbia an temperature records for many representative stations.

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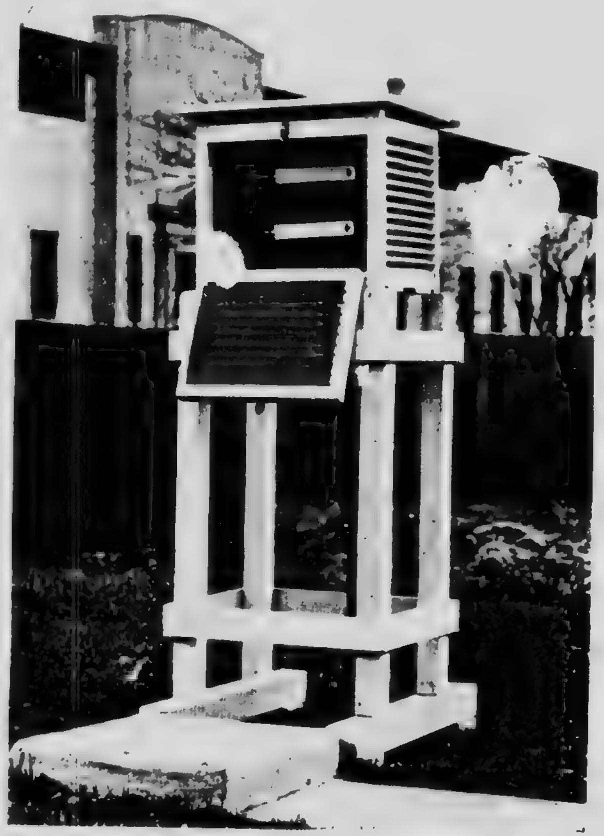
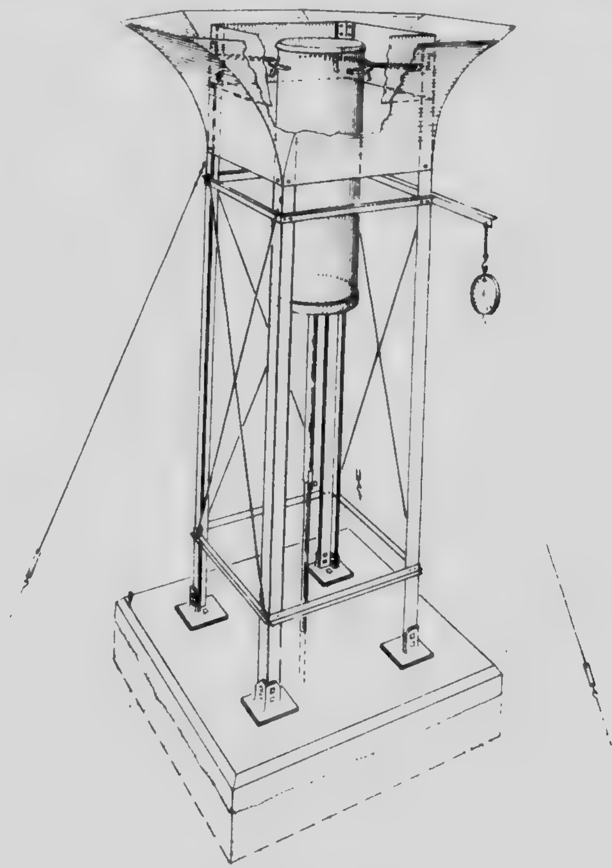
*Consult 'The Value of Snow Surveys as related to Irrigation Project by Alfred H. Thiesson, Section Director, U. S. Weather Bureau, in *Year Boo of Department of Agriculture*, Washington, D.C., 1911, pp. 391-396, illus.; als *Measuring the Snow in Maple Creek Cañon, Utah*, by Alfred H. Thiesson an J. Cecil Alter (Weather Bureau); also ***Instructions for Installing Snow-stakes*** *a Scales for Measuring Depths of Snow on the Ground*, being Appendix, Circula E, Instrument Division, U. S. Weather Bureau, Washington, D.C., 1913. Se also 'The Catchment of Snowfall by Means of Large Snow Bins and Towers,' b Prof. Frank H. Bigelow, in ***Monthly Weather Review***, Vol. 38, No. 6, June, 1910 The use of bins of the type illustrated in Mr. Bigelow's paper, it is stated, being discontinued.

†See 'The Importance of Mountain Climate in the West—The Weat Bureau and the Forest Service in Co-operation,' by E. R. Hodson, Assistant, U. S Forest Service, in U. S. ***Monthly Weather Review***, 1909, Vol. 37, pp. 949-950.



THERMOMETER SHED
As used at Canadian Meteorological Observatory, Toronto.



SHIELDED SNOW GAUGE

The Dominion Meteorological Service,* Toronto, maintains a number of stations in British Columbia. The stations are classified as follows :

A. Chief stations, where all ordinary observations are taken, day and night, at equal intervals of time, not exceeding four hours.

T. Telegraph Reporting Stations, where all ordinary observations are taken three times daily at the same absolute time, namely, 8 A.M., 2 P.M., and 8 P.M., 75th meridian time, and the first and last are reported by telegraph as soon as taken, to the central office at Toronto.

I. Ordinary Stations of the First Class, where all the ordinary observations are taken three times daily at certain local times.

II. Ordinary Stations of the Second Class, where regular observations of temperature, extremes of temperature, the direction and velocity of the wind, and the state of the weather, are taken two or three times daily at regular local times, the rainfall and snowfall also being measured.

III. Ordinary Stations of the Third Class, where records are kept of the fall of rain and snow, and the general state of the weather.

In British Columbia, the only chief station is at Victoria. There are telegraph reporting stations at Atlin, Barkerville, Kamloops, Prince Rupert and Vancouver. There are also first-class stations at Entrance Island, Triangle Island and Nanaimo. The majority of the remaining stations rank as second-class. The class of each Dominion station is indicated in the tabular lists.

The British Columbia Water Rights Branch has recently established a Meteorological Section.† It has provided many new stations, and the number is being further increased. There are also several private companies, *e.g.*, the British Columbia Electric Railway Co., Campbell River Power Co., West-

* The following are publications of the Meteorological Service (Head Office, Toronto) : *Rain and Snowfall of Canada to end of 1902*, Ottawa, 1906, with charts ; *The Monthly and Annual Rain and Snowfall of Canada from 1903 to 1913*, Ottawa, 1915 ; *The Temperature and Precipitation of British Columbia*, by A. J. Connor, Ottawa, 1915. (This includes records of monthly, seasonal and annual means and extremes of temperature and precipitation from certain selected stations.) The foregoing give summaries of the data. For fuller details see : *Annual Reports of Meteorological Service of Canada*. The last *Annual Report* issued was for the year 1915, published early in 1917; consult also *Monthly Weather Review*, which gives tables of 'Pressure, Temperature, Wind, and Precipitation of Stations in the Dominion of Canada.' The former practice was to publish the records in the *Monthly Weather Review* as soon as they could be assembled after the receipt from the various stations ; subsequently, the records were again checked before being published in the *Annual Report*. Since the end of 1915, the publication of the *Monthly Weather Review* and the *Annual Report* has been discontinued, and has been superseded by the publication of the *Monthly Record of Meteorological Observations*. This publication includes the data formerly given in the two earlier publications and, when bound with a small *Supplement*, issued annually, takes the place of the former annual reports. Bound volumes are not, however, issued by the Meteorological Service. See, also, *Instructions for Recording Rain, Snow, Weather Temperature and Miscellaneous Phenomena*, issued by the Meteorological Service, Canada, Ottawa, 1893 ; consult also *The Observer's Hand Book*, approved for the use of Meteorological Observers by the Meteorological Office, the Royal Meteorological Society, the Scottish Meteorologial Society and the British Rainfall Organization, published (annually) London, England.

† Regarding publications by the Province of British Columbia, see leaflet, *Instructions for Measuring and Recording Rain and Snow*, issued by Water Rights Branch, Victoria ; also bulletin, *The Climate of British Columbia*, being tables of rainfall, snowfall and temperature, altitude of places, lakes and mountains, issued by the Bureau of Provincial Information, Victoria, B.C., last issued bulletin, No. 27, Victoria, 1914 ; also 'Report on Meteorological Work,' contained in *Annual Reports of Minister of Lands*, Victoria, B.C.

ern Canada Power Co., Powell River Co., and others, which, with commendal
foresight, have been recording meteorological phenomena.

In the United States, the Weather Bureau,* Dept. of Agriculture, Washin
ton, D.C., has for many years, maintained stations which, owing to their co
parative proximity to British Columbia, and to their being situated in are
of similar topography, are of special interest. Records of a number of statio
in Washington, Idaho, Montana and Alaska have been compiled from t
publications of the Weather Bureau and are summarized below. In additio
summaries of records from some adjacent stations in Alberta and Yukon ha
been included.

Every possible care has been exercised to make these assembled recor
reliable. They have been thoroughly checked and, where any inconsisten
was apparent, the records for stations maintained by the Dominion Gover
ment were checked, either with the original abstract books or with the origi
sheets as turned in by the observers. The provincial records were suppli
and checked by the courtesy of the Provincial Water Rights Branch.

Our thanks are due to the chief and to the section directors of the U.
Weather Bureau, for their kind assistance in providing data and, also, in so
instances, for furnishing advance copies.

Assistance to Observers

The Meteorological Service of Canada is ready to furni
apparatus for the establishment of precipitation stations, f
of charge, to any person suitably situated, who will voluntar
attend to making and transmitting the observations. Naturally, the serv
does not wish to establish stations which would probably be discontinued,
where there would be the possibility of the records being indifferently taken
transmitted, once the novelty had worn away. The accuracy of the reco
is very greatly dependent upon the faithfulness and intelligence of the observ

To those observers who desire to extend the scope of their observati
thermometers recording maxima and minima readings, may also be suppli
These temperature readings should be taken regularly, though continuity
not quite so fundamentally important as in the case of precipitation recor

Any person resident in British Columbia—especially in the less settled p
tions where no records have hitherto been taken—who is willing to devote a
minutes daily to this service, will, by so doing, be compiling records of gr
value.

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* For publications containing meteorological records of U. S. Weather Bureau, Washing
D.C., consult *Annual Reports of the Chief of the Weather Bureau*, Washington, D.C.; also S
mary of the Climatological Data for the United States by Sections. This consists of 106 sect
published from 1908-1912. The territorial sections adjacent to British Columbia are Wes
Washington, Section 19; Eastern Washington, Section 20; Northern Idaho, Section 21 ;
Western Montana, Section 28. For supplementary records consult the *Annual Summaries*
published by the various chiefs of sections of the Climatological Service of the Weather Bu
These give the data by states. See also *Monthly Weather Reviews*, which not only set forth
current data in digest form, but include monographs dealing with matters of special climatolo
interest ; also ***Measurement of Precipitation : Instructions on the Measurement and Registr***
of Precipitation by means of the Standard Instruments of the Weather Bureau, being Circula
Instrument Division, Washington, 1913, with appendices (issued separately) ; *How to Mea*
Rainfall on the Farm, and ***Instructions for use of Marvin Float Rain-Gauge***. Consult U. S. Wea
Bureau publications : ***Instructions for Co-operative Observers***, Circulars B and C, Instru
Division, Wash., D.C., 1915 ; and ***Instructions for Obtaining and Tabulating Records from***
cording Instruments, Circular A, Instrument Division, Washington, D.C., 1913.

Tabulated Data

The following tabular data are here presented :

1—Stations in British Columbia for which Precipitation Records are available.

2—Stations in Alberta and Yukon for which Precipitation Records are here presented.

Note to 1 and 2—Those interested in hydrological considerations will find these two lists of great assistance. They will facilitate the selecting of groups of stations having corresponding characteristics, such as similar elevations, lengths of records, mean annual precipitation, etc., or they will facilitate, when used in conjunction with the precipitation map, the selection of stations in specific localities or on individual watersheds. The station numbers on the list correspond, respectively, to those of the records and of the Precipitation map.

3—Precipitation Records for Stations in British Columbia.

4—Precipitation Records for Selected Stations in Alberta and Yukon.

Note to 3 and 4—Consideration of space has made it impossible to tabulate in detail the snowfall records. For the longer term records monthly and annual means, also maximum snowfall recorded in any one month, are given. For the short records the snowfall recorded is given by months.

5—Selected Precipitation Stations in United States on International Watersheds or Adjacent to British Columbia.

6—Monthly and Annual Mean Precipitation at Selected Stations in the United States on International Watersheds or Adjacent to British Columbia.

Note to 5 and 6—It was intended in this Report to present complete records for selected stations in the United States similar to the data supplied for British Columbia stations. Thus, mean monthly and annual total precipitation records for stations 300 to 370 had been assembled, while, as supplementary thereto, only summaries of data for stations 371 to 385 * were being included, because, from the viewpoint of their relationship to watersheds of international bearing, these records are of lesser importance. Many of the records 300 to 370 were lengthy, and it was subsequently found that consideration of space required that only summaries be given of the mean monthly and annual precipitation for all the stations 300 to 385.

7—Temperature Records for Selected Stations in British Columbia.

Note—The stations for which temperature records have been selected for presentation here, are indicated in items 1 and 2 above by the letter T. Although the periods of records for precipitation and temperature are not always identical, nevertheless, a comparison of the records will show that the periods for the various temperature records generally do correspond to those of the respective precipitation records.

8—Monthly and Annual Mean Temperatures at Selected Stations in the States of Montana, Idaho and Washington.

* These, conforming to the numerical sequence on the *map*, are below presented under heading 'Supplementary.'

STATIONS IN BRITISH COLUMBIA FOR WHICH PRECIPITATION RECORDS ARE AVAILABL

No. on map	Station	Lat. N.	Long. W.	Elev.*	Limiting dates	Complete years	Scattered record		Average annual total precipitation	Aut it
							Mths.	Yrs.		
		° ′	° ′	feet		a	b	c	inches	
1	Abbotsford (T)**	49- 3	122-17	89	Jan. 1889-Aug. 1904	15	8	1	60·15	D-
2	Agassiz (T)	49-14	121-46	52	Oct. 1889-Dec. 1915	25	14	2	64·67	D-
3	Akamina	Short	record	for 2 m	onths only in 1912.					
4	Alberni (Beaver Creek P.O.) (T)	49-20	124-55	300	Apr. 1894-Dec. 1915	19	20	2	68·79	D-
5	Alberni (Beaver Creek)	49-20	124-53	.....	Jan. 1895-Dec. 1899	5	0	0	70·45	D-
6	Alberni (Stamp Falls)	49-18	124-52	.....	Jan. 1914-Apr. 1914	0	4	1	......	D-
7	Alberni Townsite	49-17	124-50	N.S.L.‡	Sep. 1904-Mar. 1910	4	12	3	73·42	D-
8	Alert Bay (Dominion)	50-35	126-58	N.S.L.	Dec. 1913-Nov. 1915	1	12	2	......	D-
9	Alert Bay (Provincial)	50-35	126-58	N.S.L.	Dec. 1913-Dec. 1915	2	1	1	......	Pr
10	Alkali Lake	51-47	122-19	.....	Sep. 1910-Dec. 1915	4	14	2	12·13	D-
11	Alouette (Lillooet) Lake	49-17	122-29	400	Aug. 1911-Dec. 1915	4	5	1	96·54	(
12	Alvaston	50- 3	119-27	1,325	June 1915-Dec. 1915	0	7	1	......	D-
13	Annis (Canoe point)	50-47	119- 5	1,160	June 1910-Dec. 1915	5	7	1	22·77	D-
14	Armstrong	50-26	119-12	1,190	Jan. 1912-Dec. 1915	4	0	0	19·38	D-
15	Ashcroft	50-43	121-16	1,000	Sep. 1912-Dec. 1915	1	15	3	......	Pr
16	Aspen Grove	49-52	120-37	3,200	Aug. 1913-Dec. 1915	2	5	1	......	Pr
17	Athalmer	50-31	116- 2	2,620	Dec. 1903-Aug. 1909	0	24	4	......	D
18	Atlin (T)	59-35	133-38	2,240	Sep. 1905-Dec. 1915	10	4	1	10·98	D
19	Ayansh	55-18	129-10	N.S.L.	June 1914-Dec. 1915	1	7	1	......	Pr
20	Babine Lake	55- 5	126-26	2,230	Oct. 1908-Dec. 1915	1	43	7	21·59	D
21	Banfield	48-50	125- 9	50	Feb. 1903-Dec. 1906	2	21	2	91·28	D
22	Barkerville (T)	53- 2	121-35	4,180	Jan. 1888-Dec. 1915	25	32	3	35·09	D
....	Barriere Valley	See L	ouis Cr	eek						
23	Baynes Lake	49-13	115-12	2,800	Jan. 1915-Dec. 1915	0	11	1	......	D
24	Bevan	49- 5	125- 5	440	Aug. 1914-Dec. 1915	1	5	1	......	Pr
....	Bear Creek	See J	ordan R	iver						
....	Beaver Creek P.O.	See A	lberni	(Beaver	Creek) P.O.					
....	Beaver Creek	See A	lberni	(Beaver	Creek)					
....	Beaver Lake	See V	ictoria	Waterw	orks					
25	Bellakula (T)	52-20	126-54	150	June 1898-Dec. 1915	14	31	4	41·31	D
....	Big Creek	See C	hilcotin							
26	Birchbank	49-11	117-43	1,400	Sep. 1913-Dec. 1915	2	4	1	......	Pr
....	Boatswain Bank	See C	obble H	ill						
27	Bonnington Falls	49-27	117-30	1,650	Sep. 1913-Dec. 1915	2	4	1	......	Pr
28	Boswell	49-28	116-46	1,780	Mar. 1911-Dec. 1915	1	14	2	......	D
29	Bridge River	50-48	122-19	1,800	July 1913-Dec. 1915					
30	Brisco (46-mile)	50-50	116-18	2,600	Sep. 1913-Dec. 1915	2	6	1	......	P
31	Britannia Beach	49-37	123-12	165	Dec. 1913-Dec. 1915	2	4	1	......	P
32	Britannia (Tunnel)	49-37	123-11	2,200	June 1914-Dec. 1915	2	1	1	......	D
33	Britannia (Mine)	49-37	123-10	3,700	June 1914-Nov. 1915	1	7	1	......	P
..	Bullion	See Q	uesnel	Forks		..	14	2	......	P
34	Buntzen Lake	49-21	122-52	400	Jan. 1903-Dec. 1915	13	0	0	109·79	
35	Bute Inlet (Southgate R.)	50-52	124-50	N.S.L.	Sep. 1914-Dec. 1915	1	4	1	......	P
36	Cache Creek	50-49	121-20	1,250	Aug. 1913-Dec. 1915	2	4	1	......	P
37	Cameron Lake	49-17	124-35	640	Nov. 1914-Dec. 1915	1	2	1	......	P
....	Campbell Lake	See S	trathco	na Park						
38	Campbell River	50- 2	125-20	80	May 1910-May 1914	3	13	2	55·85	
39	Canalflat	50-10	115-50	2,656	Nov. 1913-Dec. 1915	2	2	1	......	P
40	Canobie (nr. Hayward Junc.)	48-49	123-44	100	Jan. 1895-Dec. 1896	2	0	1	......	D
....	Canoe Point	See A	nnis							
....	Cape Scott	See H	olberg							
41	Capilano Intake	49-23	123- 8	480	July 1914-Dec. 1915	1	6	1	......	P
42	Carmanah	48-38	124-47	130	Jan. 1892-June 1902	10	6	1	109·47	D
43	Carmi	49-30	119- 9	2,780	Oct. 1913-Dec. 1915	2	3	1	......	P
44	Caulfield	49-21	123-16	30	Jan. 1902-Apr. 1903	1	4	1	......	D
45	Chilcotin (Big Creek)(T)	51-43	123- 3	3,100	Dec. 1892-Dec. 1915	12	49	9	12·36	D
46	Chilliwack (T)	49-10	121-57	21	Jan. 1878-Dec. 1915	16	54	7	60·21	D
47	Chinook Cove (Dom.)	51-16	120-11	1,300	Jan. 1914-Dec. 1915	2	0	0	......	D
48	Chinook Cove (Prov.)	51-16	120-11	1,300	Sep. 1913-Dec. 1915	2	4	1	......	P
49	Christina Lake	49- 3	118-13	1,460	Sep. 1913-Dec. 1915	2	4	1	......	P
50	Clayoquot (T)	49- 9	125-55	40	June 1898-Dec. 1915	15	18	3	118·24	D
51	Clinton	51- 6	121-36	3,040	Jan. 1881-Dec. 1889	2	53	7	5·70	D
52	Clo-oose	48-40	124-50	30	June 1912-Dec. 1915	3	7	1	......	D
53	Cobble Hill	48-41	123-36	33	Oct. 1913-Dec. 1915	2	3	1	......	D
54	Coldspring Ranch	50-13	120-22	2,700	Aug. 1913-Dec. 1915	2	5	1	......	P
....	Comfort Ranch	See I	nverme	re						
55	Coquitlam	49-15	122-46	34	Jan. 1902-Dec. 1915	13	11	1	70·57	D
56	Coquitlam Lake Dam	49-21	122-48	450	Jan. 1903-Dec. 1915	13	0	0	149·16	(3

* Where the exact elevation of the observing station is unknown, figures in this column represent the elev of nearby points, such as the local railway station; many of these elevations have been taken from *Altitu Canada*, 2nd ed., 1915, by James White.

a. Number of complete calendar years.
b. Number of additional months in incomplete years.
c. Number of incomplete years.

† In this column, "Prov." indicates records supplied by Provincial Water Rights Branch. "D–I," " I etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 543.

** For stations marked (T), temperature records are also given in this chapter.

‡ N.S.L. denotes "Near sea level."

(1) Records by the British Columbia Electric Railway Company.
(2) Records by the Campbell River Power Company.
(3) Records by the British Columbia Electric Railway Company.

STATIONS IN BRITISH COLUMBIA FOR WHICH PRECIPITATION RECORDS ARE AVAILABLE
—*Continued*

No. on map	Station	Lat. N.	Long W.	Elev.*	Limiting dates	Complete years	Scattered record Mths.	Scattered record Yrs.	Average annual total precipitation	Authority †
		° ′	° ′	feet		a	b	c	inches	
57	Coronation	50-51	122-21	3,750	Started May, 1915	0	8	1	......	D-II
58	Cortes (Twin Island)	50- 4	125- 2	N.S.L. ‡	Jan. 1915-June 1915	0	6	1	......	D-III
59	Cowichan (T)**	48-47	123-38	170	Feb. 1904-Dec. 1915	10	17	2	39·95	D-II
60	Cowichan Bay	48-44	123-37	50	Sep 1914-Dec. 1915	1	4	1	......	Prov.
61	Cowichan Lake	48-50	124- 5	540	Aug. 1913-Dec. 1915	2	5	1	......	Prov.
62	Cranberry Lake	52-50	119-20	2,460	Jan. 1914-Dec. 1915	0	12	2	......	D-II
63	Cranbrook (T)	49-31	115-46	3,014	Aug. 1901-Dec. 1915	6	48	7	16·24	D-II
64	Cranbrook City	49-31	115-46	3,020	Oct. 1913-Dec. 1915	2	3	1	......	Prov.
65	Crawford Bay	49-42	116-48	2,000	Aug. 1907-Dec. 1915	4	9	2	......	D-II
66	Creston	49- 5	116-31	1,985	June 1912-Dec. 1915	3	7	1	......	D-II
67	Creston (Reclamation Farm)	49- 5	116-36	.....	Mar. 1896-Aug. 1904	7	18	2	23·42	D-II
68	Crows Nest	49-39	114-42	4,450	July 1914-Dec. 1915	1	6	1	......	Prov.
69	Cumberland	49-37	125- 1	.....	Mar. 1898-Dec. 1900	1	17	2	......	D-III
70	Deer Park	49-24	118- 2	1,450	Feb. 1914-Dec. 1915	1	11	1	......	Prov.
71	Denman Island	49-33	124-50	40	July 1906-Dec. 1915	7	23	3	50·86	D-III
72	Departure Bay	49-12	123-57	N.S.L.	Jan. 1913-Dec. 1915	3	0	0	......	D-II
73	Donald	51-28	117-11	2,090	Mar. 1895-Nov. 1899	1	36	4	26·12	D-II
74	Douglas Lake	50-14	120-11	2,600	Feb. 1878-Oct. 1886	1	25	3	......	D-III
75	Duck Lake Ranch	50- 0	119-23	1,400	Apr. 1913-Nov. 1914	0	18	2	......	D-II
..	Ducks	See Monte Creek								
76	Duncan	48-45	123-42	40	Jan. 1895-June 1903	9	27	3	......	D-III
77	East Arrow Park	50- 6	117-56	1,413	Mar. 1914-Dec. 1915	1	10	1	......	D-II
78	Echo Lake	56-56	130-12	3,714	Aug. 1914-Dec. 1915	1	5	1	......	Prov.
79	Edgewater (Brisco)	50-42	116- 8	2,620	Sep. 1913-Dec. 1915	0	22	3	......	Prov.
80	Edith Lake	50-34	120-20	3,200	Dec. 1914-Dec. 1915	1	1	1	......	D-II
...	Elko	See Fruitlands								
81	Elko City	49-18	115- 7	3,100	Sep. 1913-Dec. 1915	2	4	1	......	Prov.
82	Enderby	50-33	119- 9	1,180	Jan. 1894-Dec. 1915	13	29	4	20·29	D-II
83	Entrance Island	49-13	123-49	45	Jan. 1915-Dec. 1915	1	0	0	......	D-T
..	Esquimalt	See Victoria								
84	Estevan Point	49-22	126-33	N.S.L.	Jan. 1909-Dec. 1909	1	0	0	......	D-I
85	Fairview	49-11	119-36	.....	May 1906-Feb. 1912	2	17	3	......	D-II
..	Fauquier	See Needles								
86	Ferguson	50-41	117-29	.....	June 1908-Dec. 1915	7	7	1	48·92	D-III
87	Fernie (Dom. sta.)	49-30	115- 3	3,305	Dec. 1913-Dec. 1915	2	1	1	......	D-II
88	Fernie (Prov. sta.)	49-30	115- 3	3,305	May 1914-Dec. 1915	1	8	1	......	Prov.
89	Fifteen-mile Ranch	50-54	121-47	.....	Nov. 1913-Oct. 1915	1	11	2	......	D-II
90	Fifth Cabin	56-23	127-53	.....	June 1914-Dec. 1915	1	7	1	......	Prov.
91	Fort George (See Prince George)									
92	Fort St. James (T)	54-28	124-12	2,280	Jan. 1894-Dec. 1915	22	0	0	15·65	D-II
93	Fort St. John	56-15	120-54	1,500	Jan. 1910-July 1911	0	15	2	......	D-II
94	Fort Steele (See Steele)									
95	French Creek (T)	49-21	124-22	125	Jan. 1892-Mar. 1903	11	3	1	36·00	D-II
96	Fruitlands (1) (T)	49- 1	115- 5	2,684	Feb. 1896-Dec. 1915	16	43	4	18·57	D-II
97	Fruitvale	49- 7	117-33	1,984	Feb. 1910-Aug. 1911	0	19	2	......	D-II
....	Garry Point	See Steveston								
....	Gateway (now Newgate)	See Newgate								
98	Gillis Bay (Texada Id.)	49-40	124-32	N.S.L.	Apr. 1913-Dec. 1915	2	9	1	......	D-II
99	Glacier (T)	51-16	117-30	4,072	Jan. 1894-Dec. 1915	9	59	8	58·46	D-II
100	Glenemma	50-22	119-19	.....	Nov. 1914-Dec. 1915	1	2	1	......	D-II
.	Goat River Lodge	See Powell Lake								
101	Golden (T)	51-18	116-58	2,550	Apr. 1902-Oct. 1915	7	27	5	18·40	D-II
102	Goldstream Lake	48-29	123-37	1,505	Aug. 1894-Dec. 1915	21	5	1	65·04	D-III
103	Grand Forks	49- 2	118-28	1,746	Sep. 1909-Dec. 1915	6	4	1	16·71	D-II
104	Grand Forks	49- 2	118-28	1,750	Aug. 1913-Dec. 1915	2	5	1	......	Prov.
105	Grand Prairie	50-28	119-46	2,157	Nov. 1882-Dec 1890	1	12	3	......	D-II
106	Greenwood	49- 6	118-41	2,400	June 1911-Dec. 1915	2	21	3	18·11	D-II
107	Griffin Lake	50-57	118-30	1,517	Jan. 1893-Dec. 1900	3	35	5	35·08	D-II
108	Harrison Springs	49-18	121-46	50	July 1889-Dec. 1889	0	6	1	......	D-II
109	Harpers Camp	52-20	121-25	2,400	June 1914-Dec. 1915	1	7	1	......	Prov.
110	Harper Ranch	50-43	120-32	1,245	Jan. 1913-Sep. 1913	0	9	1	......	D-II
111	Hartley Bay	53-27	129-16	N.S.L.	Nov. 1905-Nov. 1907	0	24	3	125·89	D-III
112	Hatzic	49- 9	122-14	32	Oct. 1896-Feb. 1898	1	5	2	......	D-III
113	Hazelmere	49- 2	122-42	200	Mar. 1893-July. 1901	6	28	3	50·23	D-II
114	Hazelton	55-15	127-44	975	Sep. 1896-Dec. 1897	0	7	2	......	D-II
...	Hazelton, New	See New Hazelton								
115	Hedley (T)	49-21	120- 5	1,771	May 1904-Dec. 1915	10	19	2	11·52	D-II
116	Hedley (Nickel Plate Mine) (T)	49-23	120- 2	4,500	Feb. 1904-Dec. 1915	7	14	5	23·22	D-II

* Where the exact elevation of the observing station is unknown, figures in this column represent the elevation of nearby points, such as the local railway station; many of these elevations have been taken from *Altitudes in Canada*, 2nd ed., 1915, by James White.

a. Number of complete calendar years.

b. Number of additional months in incomplete years.

c. Number of incomplete years.

† In this column, "Prov." indicates records supplied by Provincial Water Rights Branch. "D-I," "D-II," etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 513.

** For stations marked (T), temperature records are also given in this chapter.

‡ N.S.L. denotes "Near sea level."

(1) Formerly Tobacco Plains.

STATIONS IN BRITISH COLUMBIA FOR WHICH PRECIPITATION RECORDS ARE AVAILABL
—Continued

No. on map	Station	Lat. N.	Long. W.	Elev.*	Limiting dates	Complete years	Scattered record Mths.	Scattered record Yrs.	Average annual total precipitation
		° ′	° ′	*feet*		*a*	*b*	*c*	*inches*
117	Holberg and Cape Scott (T)**	50-39 |	128- 3 |	N.S.L. ‡	Apr. 1897-Dec. 1915	15	30	4	120·89
118	Holt Creek	48-45	123-48	300	Oct. 1914-Dec. 1915	1	3	1	......
119	Hope	49-23	121-26	500	Jan. 1878-Dec. 1915	7	23	3	53·27
120	Hornby Island	49-32	124-43	40	Dec. 1907-Dec. 1915	6	15	3	44·60
121	Howser	50-18	116-58	1,875	Sep. 1912-Aug. 1914	1	12	2	......
122	105-mile House	51-45	121-25	3,000	July 1913-Dec. 1915	2	6	1	......
123	Hydraulic	52-38	121-48	2,000	Apr. 1912-Jan. 1915	2	10	2	......
124	Hydraulic (Swift River Dam)	52-49	121-49	2,700	Dec. 1910-Oct. 1913	1	21	3	28·15
125	Ikeda Bay (T)	52-17	131- 7	5	July 1908-Dec. 1915	3	46	5	107·42
126	Invermere	50-30	116- 4	3,340	Aug. 1913-Dec. 1915	2	5	1	......
127	Invermere (Exp. Farm)	50-30	116- 2	2,650	Nov. 1912-Dec. 1915	3	2	1	......
128	Invermere Heights	50-56	116-22	2,600	Oct. 1913-Dec. 1915	2	3	1	......
129	James Island	48-37	123-22	N.S.L.	Feb. 1914-Dec. 1915	1	11	1	......
130	Jones Lake	49-14	121-36	2,050	May 1910-Dec. 1915	5	8	1	80·90
131	Jordan River (Shirley)	48-26	124- 3	N.S.L.	Dec. 1907-Dec. 1915	8	1	1	70·08
132	Jordan River (Bear Cr.)	48-31	123-56	3,670	Nov. 1910-Dec. 1915	5	2	1	94·18
133	Kamloops (T)	50-40	120-20	1,245	Jan. 1878-Dec. 1915	22	35	7	10·26
134	Kaslo	49-55	116-56	1,752	Jan. 1895-Dec. 1915	2	36	4	25·76
135	Kelowna	49-54	119-18	......	Apr. 1914-Dec. 1915	1	9	1	......
136	Kelowna (Hydraulic Summit)	49-45	119-11	4,120	Oct. 1912-Dec. 1915	2	12	2	......
137	Kelowna (T) (Okanagan Mission)	49-49	119-29	1,200	Jan. 1878-Dec. 1915	17	47	6	12·75
138	Kelowna (Rutland)	49-51	119-18	1,870	Jan. 1911-Dec. 1915	5	0	0	12·65
139	Keremeos (Dominion)	49-13	119-50	1,372	Jan. 1891-June 1915	5	36	4	8·58
140	Keremeos (Provincial)	49-13	119-50	1,361	July 1913-Dec. 1915	2	6	1	......
....	Khatada River	See Skeena							
141	Kingsgate	49- 0	116-11	2,600	Nov. 1913-Dec. 1915	2	2	1	......
142	Kitimat	53-59	128-42	N.S.L.	Oct. 1902-Mar. 1910	3	21	3	81·47
143	Kl:naklini	51-57	124-35	3,000	July 1914-Dec. 1915	1	6	1	......
144	Knouff	50-57	120-11	3,000	Started Aug. 1915	0	5	1	......
145	Kuper Island	48-58	123-38	20	Aug. 1894-Dec. 1904	9	12	2	43·30
146	Ladner (T)	49- 5	123- 5	N.S.L.	Feb. 1878-Dec. 1915	17	57	6	36·70
147	Ladysmith	49- 0	123-49	68	May 1913-Dec. 1915	2	8	1	......
148	Langley	49-10	122-34	22	Jan. 1878-Oct. 1900	15	40	4	54·86
149	Laso (Little River)	49-44	124-54	12	Apr. 1914-Dec. 1915	1	9	1	......
150	Lazy "L" Ranch	50-16	120-48	....	Oct. 1913-Dec. 1915	2	3	1	......
151	Lillooet	50-42	121-56	840	Jan. 1878-Nov. 1883	5	11	1	14·97
....	Lillooet Lake	See Alouette Lake							
....	Little Qualicum	See Qualicum							
152	Louis Creek	51-10	120- 8	1,230	May 1912-Sep. 1912	0	5	1	......
153	Lumby	50-14	118-58	....	Oct. 1912-May 1915	2	8	2	17·04
154	Lynch Creek	49-15	118-26	1,900	Aug. 1913-Dec. 1915	2	5	1	......
155	Lynn Creek	49-20	123- 2	637	June 1913-Dec. 1915	2	7	1	......
156	Malakwa	50-56	118-48	1,215	May 1914-Dec. 1915	1	8	1	......
157	Mamit Lake	50-24	120-48	3,300	June 1914-Dec. 1915	1	6	1	......
....	Maple Grove	See Abbotsford							
158	Mary Island	50- 8	125- 6	25	Apr. 1914-Dec. 1915	1	9	1	......
159	Masset (T)	53-58	132- 9	30	June 1897-Dec. 1915	13	55	6	53·05
....	Matsqui Prairie	See Abbotsford							
160	Metchosin	48-23	123-32	80	Aug. 1915-Dec. 1915	0	5	1	......
161	McClure Lake (Telkwa)	54-50	126-53	1,670	Nov. 1913-Dec. 1915	2	2	1	......
162	McCoy Lake (Alberni)	49-20	124-47	......	Aug. 1896-Feb. 1898	1	7	2	......
163	Midway	49- 1	118-47	1,914	Aug. 1895-Mar. 1904	7	11	3	12·43
164	Mill Bay (Nass)	55- 0	129-47	30	Sep. 1913-Dec. 1915	2	4	1	......
....	Mill Creek	See Nicola-Clapperton Creek Watershed							
165	Monte Creek (Ducks)	50-38	119-57	1,156	May 1908-Dec. 1915	5	29	3	10·75
166	Moha	51- 4	122-28	......	Oct. 1913-Dec. 1915	2	3	1	......
167	Nakusp	50-14	117-49	1,413	Mar. 1912-Dec. 1915	3	10	1	27·94
168	Nanaimo (T)	49-10	123-37	125	Jan. 1892-Dec. 1915	18	36	5	41·32
169	Nanaimo (2)	49-10	123-37	N.S.L.	Mar. 1901-Apr. 1909	7	14	2	42·32
170	Nanoose Bay	49-17	124-12	130	May 1912-Dec. 1915	3	7	1	33·03
171	Naramata	49-36	119-36	1,150	Apr. 1913-Dec. 1915	1	19	2	......
172	Nass Harbour	54-56	129-57	20	Feb. 1900-Dec. 1915	13	30	3	78·69
173	Needles (Fauquier)	49-51	118- 6	1,430	July 1909-Dec. 1915	3	25	4	23·41
174	Nelson (T)	49-29	117-18	1,760	Sep. 1898-Dec. 1915	10	50	6	27·56
175	New Denver	49-59	117-23	1,800	Mar. 1914-Dec. 1915	1	10	1	......

* Where the exact elevation of the observing station is unknown, figures in this column represent the ele of nearby points, such as the local railway station; many of these elevations have been taken from *Altitud Canada*, 2nd ed., 1915, by James White.

a. Number of complete calendar years.

b. Number of additional months in incomplete years.

c. Number of incomplete years.

† In this column, "Prov." indicates records supplied by Provincial Water Rights Branch. "D-I," "I etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 513.

** For stations marked (T), temperature records are also given in this chapter.

‡ N.S.L. denotes "Near sea level."

\| Lat. and Long. of Holberg.

(1) Records by the British Columbia Electric Railway Company.

(2) Record by Mr. Good.

STATIONS IN BRITISH COLUMBIA FOR WHICH PRECIPITATION RECORDS ARE AVAILABLE
—Continued

No. on map	Station	Lat. N.	Long. W.	Elev.*	Limiting dates	Complete years	Scattered record Mths.	Scattered record Yrs.	Average annual total precipitation	Authority †
		° '	° '	feet		a	b	c	inches	
176	Newgate	49- 0	115-10	2,400	Apr. 1911-Dec. 1915	1	9	1	......	D-II
177	Newgate (Yakite Ranch)	49- 0	115-10	2,400	Oct. 1913-Dec. 1915	2	3	1	......	Prov.
178	New Haselton	55-15	127-44	1,030	Aug. 1914-Dec. 1915	1	5	1	......	D-II
179	New Westminster (T)**	49-13	122-54	330	Jan. 1874-Dec. 1915	37	13	3	58·03	D-II
....	Nickel Plate Mine	See Hedley								
180	Nicola-Clapperton Creek Watershed	50-18	120-39	3,100	Aug. 1913-Dec. 1915	2	5	1		Prov.
181	Nicola Lake (T)	50- 9	120-39	2,120	Jan. 1878-Dec. 1915	35	27	3	11·09	D-II
182	Ninth Cabin	56-52	129-37	......	Nov. 1914-Dec. 1915	1	2	1	......	Prov.
183	Nitinat Lake	48-41	124-50	N.S.L. ‡	Sep. 1914-Dec. 1915	1	4	1	......	Prov.
184	North Bend	49-42	121-26	495	May 1915-Dec. 1915	0	8	1	......	D-II
185	North Nicoamen (T)	49-12	122- 2	59	Jan. 1893-Dec. 1915	22	9	1	74·49	D-II
186	North Thompson (near Kamloops)	50-41	120-20	1,160	Aug. 1913-Oct. 1914	0	15	2	......	Prov.
187	Observation Bay	50-20	125-22	N.S.L.	Started April 1915	0	9	1	......	Prov.
188	Ocean Falls (1)	52-22	127-47	N.S.L.	Jan. 1915-Dec. 1915	0	11	1	......	Prov.
....	Okanagan Mission	See Kelowna								
189	Oyster Bay	49-52	125- 8	N.S.L.	Started Oct. 1915	0	3	1	......	Prov.
190	Parksville	49-19	124-19	200	Oct. 1915-Dec. 1915	0	3	1	......	D-III
....	Pavilion	See 15-Mile Ranch								
191	Peachland	49-45	119-45	1,160	Sep. 1913-Dec. 1915	1	15	2	......	Prov.
192	Pemberton Hatchery (T)	50-20	122-35	700	Apr. 1908-Dec. 1915	7	9	1	31·30	D-II
193	Pemberton Meadows	50-24	122-55	700	Sep. 1912-Dec. 1915	3	4	1	36·35	D-II
194	Penticton (T)	49-30	119-35	1,150	Apr. 1907-Dec. 1915	5	39	4	11·57	D-II
195	Penticton (Carmi Road)	49-29	119-27	......	Sep. 1913-Feb. 1915	0	15	3	......	Prov.
196	Perry Siding	49-39	117-30	1,700	Apr. 1913-Dec. 1915	2	9	1	25·53	D-II
197	Phoenix	49- 6	118-37	4,800	Aug. 1913-Dec. 1915	2	5	1	......	Prov.
198	Pilot Bay (T)	49-39	116-53	1,780	Nov. 1893-Dec. 1901	3	33	5	37·01	D-II
....	Point Garry	See Steveston								
199	Point Grey	Station commenced recording Jan., 1916								
200	Port Essington	54- 9	129-55	10	Apr. 1900-Nov. 1905	3	28	3	126·19	D-III
201	Port Moody	49-16	122-52	65	Oct. 1886-July 1892	4	18	3	71·94	D-II
202	Port Moody (Provincial)	49-16	122-52	N.S.L.	Jan. 1914-Dec. 1915	2	0	0	......	Prov.
203	Port Simpson (T)	54-34	130-26	26	June 1886-June 1910	20	43	5	92·29	D-I
204	Powell River	49-55	124-41	N.S.L.	May 1910-Dec. 1915	5	8	1	37·34	(2)
205	Powell River (Goat River Lodge)	50- 2	124-25	160	May 1914-Dec. 1915	1	8	1	......	(2)
206	Powell River (Head of lake)	50-20	124- 7	160	Apr. 1914-Dec. 1915	1	9	1	......	(2)
91	Prince George	53-55	122-48	1,863	Aug. 1912-Sep. 1915	0	35	4	......	D-II
207	Prince Rupert (T)	54-18	130-18	170	Aug. 1908-Dec. 1915	6	13	2	109·56	D-T
208	Princeton (T)	49-27	120-31	2,111	Jan. 1894-Dec. 1915	16	39	5	13·41	D-II
209	Princeton Crossing	49-43	120- 8	3,515	Oct. 1914-Dec. 1915	1	3	1	......	Prov.
210	Qualicum	49-18	124-18	N.S.L.	Dec. 1908-Dec. 1915	7	1	1	37·44	D-III
211	Qualicum Beach	49-21	124-26	N.S.L.	Dec. 1913-Dec. 1915	1	8	2	......	D-II
212	Quamichan	48-47	123-41	100	May 1885-Dec. 1901	8	47	7	36·78	D-II
213	Quatsino (T)	50-32	127-40	N.S.L.	July 1895-Dec. 1915	14	62	7	108·95	D-II
214	Queen Charlotte City	53-15	132- 9	N.S.L.	Oct. 1914-Dec. 1915	1	2	1	......	D-III
215	Quesnel (T)	52-59	122-30	1,700	Jan. 1895-Dec. 1915	15	52	6	14·09	D-II
	Quesnel Forks (Bullion) (T)	52-36	121-40	2,275	June 1897-Dec. 1906	9	7	1	24·03	D-II
	Quilchena	50- 9	120-32	2,900	July 1913-Dec. 1915	2	6	1	......	Prov.
218	Revelstoke (T)	50-59	118-12	1,476	May 1898-Dec. 1915	12	44	5	41·78	D-II
219	Richlands (Hilton)	50-12	118-37	2,500	Jan. 1913-Dec. 1915	3	0	0	......	D-II
220	Rivers Inlet (T)	51-41	127-19	20	Jan. 1894-Dec. 1906	13	0	0	115·43	D-II
221	Rock Creek	49- 3	119- 1	1,992	Aug. 1912-Dec. 1915	3	5	1	......	D-III
222	Rossland (T)	49- 5	117-49	3,400	Jan. 1900-Dec. 1915	12	0	0	30·89	D-II
....	Royal Oak	See Victoria Waterworks								
223	Ruskin (Stave Falls)	49-13	122-21	125	Oct. 1909-Dec. 1915	6	[illegible]	1	75·07	D-II
224	Salmon Arm (T)	50-42	119-18	1,152	Apr. 1893-June 1915	11	25	4	19·06	D-II
225	Salmon Arm (Experimental Farm)	50-44	119-12	1,150	July 1911-Dec. 191[illegible]	4	6	1	18·30	D-II
226	Salt Spring Island	48-50	123-30	N.S.L.	Apr. 1893-Dec. 1915	10	21	4	38·82	D-II
227	Sandspit (nr. Skidegate)	53-15	132- 4	N.S.L.	June 1905-Aug. 1905	0	3	1	......	D-III
228	Sandwick	49-43	125- 2	N.S.L.	Oct. 1914-Dec. 1915	1	3	1	......	D-III
229	Saturna Island	48-37	123-12	14	Apr. 1901-Feb. 1902	0	11	2	......	D-II
230	Seymour Intake	49-23	123- 0	465	Aug. 1913-Dec. 1915	2	5	1	......	Prov.
231	Shawnigan Lake	48-38	123-38	383	May 1911-Dec. 1915	4	8	1	......	D-III

* Where the exact elevation of the observing station is unknown, figures in this column represent the elevation of nearby points, such as the local railway station; many of these elevations have been taken from *Altitudes in Canada*, 2nd ed., 1915, by James White.

a. Number of complete calendar years.
b. Number of additional months in incomplete years.
c. Number of incomplete years.

† In this column, "Prov." indicates records supplied by Provincial Water Rights Branch. "D-I," "D-II," etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 513.
** For stations marked (T), temperature records are also given in this chapter.
‡ N.S.L. denotes "Near sea level."
(1) A few records were taken at Ocean Falls before 1915, but are not considered reliable.
(2) Records by Powell River Company.

STATIONS IN BRITISH COLUMBIA FOR WHICH PRECIPITATION RECORDS ARE AVAILABL

—*Continued*

No. on map	Station	Lat. N.	Long W.	Elev.*	Limiting dates	Complete years	Scattered record Mths.	Scattered record Yrs.	Average annual total precipitation	Aut it
		° ′	° ′	*feet*		*a*	*b*	*c*	*inches*	
....	Shirley	See Jordan River								
232	Shuswap Falls	50–18	118–40	1,600	Jan. 1912–Dec. 1914	3	0	0	......	(1
233	Sidney	48–39	123–24	200	Mar. 1914–Dec. 1915	1	10	1	......	D-
234	Skeena River (Falls River)	54– 1	129–48	N.S.L.‡	Mar. 1912–Feb. 1913	0	12	2	......	(2
235	Skeena River (Khatada River)	54–10	129–32	N.S.L.	Dec. 1911–Dec. 1912	0	12	2	......	(2
236	Skidegate	53–15	132– 4	N.S.L.	Nov. 1909–July 1911	0	20	3	......	D-
237	Soda Creek	52–20	122–19	1,690	Jan. 1879–Dec. 1915	5	13	2	......	D-
....	Somas River	See Alberni								
238	Sooke	48–22	123–44	25	Jan. 1903–Dec. 1915	8	11	2	51·47	D-
239	Sooke Lake	48–34	123–40	500	Sep. 1913–Dec. 1915	2	4	1	......	D-
240	Sorrento	50–52	119–29	1,180	Aug. 1913–Dec. 1915	2	5	1	......	Pr
....	Southgate River	See Bute Inlet								
241	Spence Bridge	50–25	121–20	770	Jan. 1873–Dec. 1908	13	83	14	8·00	D-
....	Spillimacheen (46-mile)	See Brisco								
....	Stamp Falls	See Alberni (Stamp Falls)								
242	Stave Lake (Upper)	49–18	122–18	250	Started July 1915	0	6	1	......	Pr
....	Stave River Falls	See Ruskin								
94	Steele	49–37	115–38	2,433	Jan. 1893–Dec. 1915	6	5	2	......	D-
243	Steveston (Garry Pt.)(T)	49– 7	123–11	6	Feb. 1896–Dec. 1915	19	11	1	37·75	D-
244	Stewart	55–57	130– 0	215	Sep. 1910–Dec. 1915	2	35	4	65·00	D-
245	Strathcona Park	49–52	125–38	980	Oct. 1913–Nov. 1914	0	14	2	......	Pr
....	Stuart Lake	See Fort St. James								
246	Sugar Lake (head of)	50–25	118–30	2,080	Apr. 1912–Dec. 1913	1	8	1	......	(3
247	Summerland (T)**	49–36	119–40	1,100	July 1907–Dec. 1915	8	6	1	11·67	D-
248	Swanson Bay (T)	53– 2	128–32	N.S.L.	May 1907–June 1913	5	14	2	179·07	D-
....	Swift River Dam	See Hydraulic								
249	Tappen	50–47	119–20	1,350	Jan. 1913–Dec. 1915	3	0	0	......	D-
....	Telkwa	See McClure Lake.								
250	Terrace	54–30	128–30	545	Oct. 1912–Dec. 1915	2	11	2	41·11	D-
251	Tête Jaune	52–56	119–31	2,400	Apr. 1914–Dec. 1915	1	9	1	......	Pr
252	Thetis Island	49– 0	123–40	N.S.L.	Mar. 1904–Dec. 1908	2	25	3	41·53	D-
253	Thrums	49–21	117–35	1,500	Aug. 1913–Dec. 1915	2	5	1	......	Pr
....	Tobacco Plains	See Fruitlands								
254	Tranquille	50–41	120–30	1,142	Mar. 1911–Dec. 1915	2	32	3	9·83	D-
255	Triangle Island	50–52	129– 5	680	May 1910–Dec. 1915	5	8	1	63·04	D-
....	Twin Island	See Cortes.								
256	Ucluelet	48–58	125–32	N.S.L.	June 1914–Dec. 1915	1	7	1	......	D-
257	Union	49–37	125– 1	.....	Dec. 1893–Feb. 1898	3	13	3	......	D-
....	Vananda	See Gillis Bay								
258	Valdes Island	49– 6	123–40	N.S.L.	Oct. 1895–Apr. 1899	3	7	2	56.72	D-
259	Vancouver (T)	49–17	123– 5	136	Oct. 1898–Dec. 1915	14	19	4	59·42	D-
260	Vancouver, City Hall	49–17	123– 5	100	June 1913–Dec. 1915	2	7	1	......	Pr
261	Vancouver, Court House	Station commenced recording Jan. 1916				.....	.....	.....	......	Pr
262	Vavenby	51–35	119–47	1,430	Apr. 1913–Dec. 1915	2	9	1	......	D-
263	Vernon (T)	50–16	119–16	1,575	June 1895–Dec. 1915	14	47	6	14·48	D-
....	Vesuvius Bay	See Salt Spring Island								
264	Victoria and Esquimalt (T)	48–26	123–22	N.S.L.	Jan. 1875–Dec. 1915	40	7	1	29·94	D
265	Victoria Waterworks	48–31	123–21	.....	Jan. 1895–Dec. 1915	21	0	0	34·54	D
266	Waneta (Pend-d'Oreille)	49– 0	117–37	2,260	Mar. 1913–Dec. 1915	2	10	1	......	D
267	Welcome Harbour (Porcher Id.)	53–55	130–22	N.S.L.	June 1914–Dec. 1915	0	4	2	......	D
268	Westley	49–20	117–45	1,414	Feb. 1914–Dec. 1915	1	11	1	......	D
....	West Kootenay Reclamation Farm	See Creston								
269	White Lake	49–19	119–40	.....	Jan. 1895–June 1895	0	6	1	......	D
270	Wilmer	50–33	116– 4	3,300	Sep. 1909–Dec. 1915	3	36	4	12·95	D
271	Wolf Creek (near Wasa)	49–47	115–40	2,550	Sep. 1913–Dec. 1915	0	21	3	......	Pr
272	Wycliffe	49–36	115–51	2,809	Apr. 1912–Nov. 1914	0	31	3	14·85	D

* Where the exact elevation of the observing station is unknown, figures in this column represent the elev of nearby points, such as the local railway station; many of these elevations have been taken from *Altitud Canada*, 2nd ed., 1915, by James White.

a. Number of complete calendar years.

b. Number of additional months in incomplete years.

c. Number of incomplete years.

† In this column, "Prov." indicates records supplied by Provincial Water Rights Branch. "D-I," "D etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 513.

** For station marked (T), temperature records are also given in this chapter.

‡ N.S.L. denotes "Near sea level."

(1) Records by Couteau Power Company.

(2) Records by Ritchie, Agnew & Company.

(3) Records by Couteau Power Company.

(4) Victoria is a chief station.

STATIONS IN ALBERTA AND YUKON FOR WHICH PRECIPITATION RECORDS ARE PRESENTED

No. on map	Station	Lat. N.	Long. W.	Elev.*	Limiting dates	Complete years	Scattered record		Average annual total precipitation	Authority †
							Mths.	Yrs.		
		° ′	° ′	feet		a	b	c	inches	
	ALBERTA									
273	Athabaska Landing	54-43	113-17	1,650	Apr. 1900-Dec. 1915	6	65	9	15·41	D-II
274	Beaverlodge (Redlow)	55-20	119-24	......	Jan. 1912-Oct. 1915	2	18	2	14·52	D-II
275	Dunvegan (Peace River)	55-56	118-35	1,305	Jan. 1880-Nov 1912	8	40	5	14·37	D-II
276	Lunnford	54- 3	114-19		Feb. 1910-Aug. 1913	1	30	3	20·12	D-II
277	Peace River Crossing	56-15	117-15	1,225	Aug. 1907-June 1914	4	29	4	14·28	D-II
278	Pembina	54-12	114- 0	......	Mar. 1908-July 1913	0	40	6	15·33	D-II
	YUKON									
279	Carcross (Conrad)	60-11	134-34	2,171	Jan. 1907-Dec. 1915	6	20	2	9·90	D-II
280	Dawson City	64- 4	139-29	1,075	Aug. 1897-Dec. 1915	12	29	4	12·92	D-T
281	Whitehorse	60-43	135- 0	2,085	Nov. 1904-Jan. 1911	4	14	3	11·37	D-II

* Where the exact elevation of the observing station is unknown, figures in this column represent the elevation of nearby points, such as the local railway station; many of these elevations have been taken from *Altitudes in Canada*, 2nd ed., 1915, by James White.

a Number of complete calendar years.

b Number of additional months in incomplete years.

c Number of incomplete years

† In this column, 'Prov' indicates records supplied by Provincial Water Rights Branch 'D I,' 'D II,' etc., indicate records supplied by Dominion Meteorological Service and show class of station. See page 513.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA

ABBOTSFORD (MATSQUI PRAIRIE)—Elevation, 89 ft.

1

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An
1889	5·72	3·51	4·60	3·95	3·28	2·06	1·50	2·45	5·33	3·70	3·79	5·63	45
1890	3·34	3·64	6·59	2·34	2·37	7·37	1·98	1·05	1·48	9·54	2·56	8·43	50
1891	7·47	2·37	6·51	6·85	2·52	6·01	0·41	1·92	8·08	5·28	10·53	10·71	[illegible]
1892	4·67	3·14	4·88	4·59	4·77	1·88	2·38	1·47	6·43	4·75	10·40	6·18	55
1893	4·09	5·56	5·67	5·58	5·85	4·35	1·33	0·94	5·78	5·56	10·65	12·42	67
1894	7·74	6·07	6·63	9·46	5·87	4·60	1·85	0·00	5·13	10·13	9·47	4·55	71
1895	6·44	6·47	5·77	4·64	6·39	2·46	0·83	0·30	6·91	0·90	6·57	8·56	56
1896	7·91	6·82	2·75	5·12	3·83	2·97	0·04	1·47	1·84	4·11	10·69	8·67	56
1897	5·68	5·35	4·73	3·93	3·21	4·76	1·75	1·07	3·82	2·63	10·30	10·93	58
1898	5·29	10·21	3·82	3·40	2·70	3·81	0·73	0·65	4·47	6·03	9·37	4·93	57
1899	7·50	6·61	3·00	5·54	5·12	2·03	1·45	3·88	1·75	4·62	13·74	9·71	64
1900	7·63	5·50	7·04	4·92	7·11	8·22	2·20	2·36	2·65	7·65	5·33	13·50	74
1901	5·97	7·59	5·48	5·43	5·74	2·99	0·98	0·09	2·71	4·63	12·29	6·10	60
1902	5·11	8·47	6·07	4·05	3·32	3·29	2·64	1·96	3·67	3·44	9·65	8·66	60
1903	8·54	1·61	6·10	2·79	3·62	3·45	3·13	2·87	2·62	3·25	11·22	7·96	57
1904	7·64	7·20	7·18	3·45	2·10	2·64	1·98	1·04	......	......	......	......	......
Means	6·30	5·64	5·43	4·75	4·24	3·93	1·57	1·47	4·18	5·08	9·10	8·46	60

During 1889-1904 (1904 incomplete), average monthly snowfall was: Jan., 6·4 in.; Feb., 7·1; Mar., 3·5;
2·7; Dec., 6·2. Mean annual snowfall, 25·9 in.; maximum recorded, 26·5 in., Feb., 1893.

AGASSIZ—Elevation, 52 ft.

2

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An
1889	......	......	......	......	......	......	......	......	......	3·65	5·77	5·23	......
1890	3·89	5·30	6·41	3·25	2·10	5·86	2·52	1·50	0·90	11·81	3·52	9·37	50
1891	......	2·34	4·24	8·14	4·15	4·18	1·04	3·94	7·83	6·51	12·77	17·92	......
1892	7·12	3·27	6·01	4·26	5·16	3·20	3·27	2·78	5·92	6·35	14·85	5·59	67
1893	5·09	8·21	6·84	6·16	6·57	5·42	1·55	1·82	4·96	6·34	11·28	12·71	76
1894	11·30	7·21	6·76	8·25	4·92	3·80	1·23	0·24	8·26	10·73	10·62	4·69	[illegible]
1895	7·45	7·73	3·79	3·03	6·44	2·45	0·95	0·70	6·67	0·74	0·81	13·74	54
1896	8·87	12·65	4·18	5·29	4·62	2·86	0·30	0·38	2·19	6·34	9·87	10·70	[illegible]
1897	6·19	2·21	7·91	3·12	4·42	12·06	4·58	1·13	6·50	6·23	5·45	3·63	[illegible]
1898	5·06	7·25	2·35	3·50	2·62	4·19	3·41	0·81	3·93	7·21	5·19	4·79	[illegible]
1899	6·70	7·86	4·71	3·27	6·62	2·42	1·76	4·17	3·07	5·36	11·44	10·15	67
1900	13·04	43·81	6·19	3·40	7·60	10·76	1·21	5·65	2·77	5·13	4·99	7·45	72
1901	6·97	5·46	3·16	3·19	4·80	7·08	1·25	0·00	1·59	4·15	10·57	4·76	52
1902	3·68	6·66	5·55	3·05	4·17	2·43	2·58	3·30	2·75	3·35	9·82	7·34	54
1903	5·39	1·40	6·04	5·30	3·58	6·03	2·30	5·08	7·30	2·71	4·42	8·20	57
1904	6·70	6·06	5·62	3·46	2·34	3·42	3·45	2·30	2·37	3·20	6·43	9·32	54
1905	5·46	4·28	5·60	4·86	8·46	3·20	2·40	2·80	8·40	8·42	2·51	4·26	60
1906	6·35	4·68	2·04	2·04	7·40	6·40	2·36	1·04	6·32	9·18	10·50	6·59	64
1907	5·33	5·90	7·46	7·40	2·30	4·36	1·06	6·40	[illegible]	1·24	8·62	4·30	57
1908	3·14	6·02	7·64	3·60	2·66	4·68	2·60	1·24	1·90	3·93	[illegible]	2·62	47
1909	4·43	5·68	2·03	4·22	3·22	2·36	3·49	3·18	6·35	5·49	20·94	2·30	63
1910	4·63	5·51	5·36	3·22	4·93	3·51	1·16	3·90	3·47	7·00	7·61	6·70	57
1911	4·98	3·56	2·66	2·48	6·57	1·65	1·12	2·97	4·91	3·67	11·04	7·69	[illegible]
1912	4·31	10·64	2·03	4·26	3·99	5·95	5·09	7·84	2·50	7·27	13·82	10·09	77
1913	13·24	5·12	7·66	4·72	6·08	7·33	3·71	2·71	7·68	8·84	12·29	3·36	[illegible]
1914	13·96	4·06	3·12	2·94	3·55	5·18	0·15	0·60	6·29	7·53	14·72	0·53	[illegible]
1915	7·17	5·67	2·45	5·37	5·20	2·36	1·62	0·07	1·26	11·26	7·75	15·39	65
Means	6·82	7·25	4·91	4·30	4·79	4·74	2·16	2·56	4·60	6·06	9·08	7·40	[illegible]

During 1889-1915 (1889 and 1891 incomplete), average monthly snowfall was : Jan., 16·4 in.; Feb., 9·2 ;
3·9 ; April, 0·3 ; Nov., 5·2 ; Dec., 6·7. Mean annual snowfall, 41·7 in.; maximum recorded, 89·0 in., Jan ,

AKAMINA (NEAR KOOTENAY PASS)

3

Short record for two months only in 1912.

ALBERNI (BEAVER CREEK P.O.)—Elevation, 300 ft.

4

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An
1894	......	......	......	6·62	1·59	2·12	0·43	0·73	7·24	13·93	7·12	10·27	......
1895	15·96	14·06	11·87	10·44	5·97	0·83	1·22	0·02	2·35	0·75	5·02	17·95	[illegible]
1896	11·70	6·76	4·95	3·58	1·59	1·03	0·00	0·24	0·14	3·63	6·38	13·50	[illegible]
1897	5·64	4·23	4·63	3·45	0·99	2·33	1·76	1·95	2·23	3·90	8·13	14·04	[illegible]
1898	4·09	14·75	0·21	5·62	1·31	4·24	0·39	0·00	4·45	3·81	11·81	......	......
1899	......	......	......	......	......	......	......	......	......	......	......	......	......
1900	11·03	4·84	9·82	2·82	4·96	4·95	1·54	1·52	1·68	11·20	8·56	19·70	[illegible]
1901	6·57	7·96	3·81	7·90	6·06	2·61	1·37	0·42	2·18	5·07	17·78	6·74	[illegible]
1902	6·96	17·33	6·01	4·97	2·09	2·61	2·28	0·88	0·84	4·82	10·16	16·26	[illegible]
1903	6·80	4·00	5·59	3·67	3·73	2·87	1·10	1·89	4·83	4·15	16·39	7·13	[illegible]
1904	14·04	11·37	6·53	4·22	2·68	0·77	1·01	1·25	0·72	6·23	20·96	13·43	[illegible]
1905	10·70	[illegible]	12·11	1·72	2·44	2·38	0·96	1·23	5·32	4·72	8·50	11·28	[illegible]
1906	13·58	7·04	5·67	2·88	3·10	4·72	0·05	0·45	7·79	11·27	10·56	9·01	[illegible]
1907	5·05	6·74	4·75	7·11	3·55	1·51	1·84	1·89	2·37	2·43	14·51	10·69	[illegible]
1908	12·13	[illegible]	5·31	5·13	3·39	0·67	0·57	0·88	1·76	5·00	22·45	8·59	[illegible]
1909	9·14	12·08	5·02	0·47	2·48	1·70	0·87	2·25	0·90	6·22	15·13	6·63	[illegible]
1910	13·21	6·79	5·42	2·76	2·58	1·97	T	0·67	2·41	7·37	12·88	9·44	[illegible]
1911	9·73	3·78	1·74	2·22	4·51	0·97	0·18	0·47	2·95	3·41	8·93	5·10	[illegible]

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

ALBERNI—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	10·57	9·77	1·02	1·75	2·57	1·54	0·83	3·28	2·06	6·98	13·54	12·67	66·58
1913	6·96	2·69	3·53	4·50	2·51	3·89	2·00	1·62	6·43	4·17	16·52	8·62	63·44
1914	16·29	5·72	8·13	7·07	1·07	3·61	0·31	0·17	7·08	16·08	14·18	2·51	82·27
1915	7·91	8·52	5·67	5·83	2·95	1·42	0·88	0·27	2·34	14·14	9·11	16·51	75·55
Means	9·90	8·34	5·59	4·51	2·96	2·32	0·93	1·05	3·24	6·64	12·31	11·00	68·79

During 1894-1915 (1894 and 1898 incomplete; 1899 no record), average monthly snowfall was: Jan., 21·5 in.; Feb., 9·6; Mar., 3·3; April, 1·0; Nov., 7·0; Dec., 8·7. Mean annual snowfall, 51·1 in.; **maximum recorded,** 67·4 in., Jan., 1911.

ALBERNI (BEAVER CREEK)*

5

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	11·74	10·46	11·58	9·27	6·90	1·40	1·05	0·30	2·41	0·74	6·01	19·51	81·37
1896	2[illegible]·60	12·56	4·65	3·92	2·69	2·90	0·09	0·37	0·27	5·65	8·97	17·27	82·94
1897	7·86	6·05	5·07	3·56	1·32	3·28	2·48	1·66	2·27	2·62	8·38	12·11	56·66
1898	4·51	13·21	0·85	5·54	2·08	4·24	0·39	0·00	3·93	4·34	9·54	6·47	54·74
1899	9·30	6·91	3·63	4·56	2·35	1·10	1·20	2·40	2·44	6·54	23·48	13·23	77·19
Means	11·40	9·84	5·16	5·37	3·07	2·58	1·04	0·95	2·[illegible]	3·98	11·08	13·72	70·45

During 1895-99, average monthly snowfall was: Jan., 15·7 in.; Feb., 6·5; Mar., 7·0; April, 0·1; Nov., 5·9; Dec., 6·9. Mean annual snowfall, 42·1 in.; maximum, 35·8 in., Jan., 1896.

ALBERNI (STAMP FALLS)

6

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	17·94	5·37	7·22	6·67	......	......	......	......	......	......	......	......	......

ALBERNI TOWNSITE, (SOMAS RIVER)—Elevation, near sea-level

7

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	......	......	......	......	......	......	......	......	1·22	5·82	24·34	14·57	......
1905	8·71	9·80	12·30	1·07	2·01	1·45	0·55	1·17	6·09	4·95	8·68	13·22	70·00
1906	11·28	6·40	5·50	3·01	2·36	3·81	0·06	0·39	8·48	11·63	11·22	9·24	73·38
1907	5·80	7·24	5·49	7·69	3·24	1·37	1·10	0·95	1·95	2·12	16·06	11·05	64·06
1908	11·52	7·75	6·87	4·98	3·12	0·86	0·17	1·16	1·49	4·89	24·84	10·24	77·89
1909	10·55	10·67	5·00	......	......	......	......	......	......	......	18·67	7·24	......
1910	15·45	6·58	5·21	......	......	......	......	......	......	......	......	......	......
Means	10·55	8·07	6·73	4·19	2·68	1·87	0·47	0·92	3·83	5·88	17·28	10·93	73·42

During 1904-10 (complete record for 1905-08), average monthly snowfall was: Jan., 15·0 in.; Feb., 8·0; Mar., 1·8; Nov., 1·7; Dec., 3·7. Mean annual snowfall, 30·2 in.; maximum recorded, 25·0 in., Jan., 1907, and Jan., 1910.

ALERT BAY (DOMINION STATION)—Elevation, near sea-level

8

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	......	4·61	......
1914	6·43	3·74	5·00	3·60	1·04	0·86	1·25	1·00	4·00	6·88	9·42	2·74	45·96
1915	5·13	3·17	2·75	3·19	3·48	0·46	1·38	0·18	1·27	11·43	5·89	......	......

ALERT BAY (PROVINCIAL STATION)—Elevation, near sea-level

9

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	......	4·61	......
1914	6·43	3·84	5·00	3·60	1·04	0·86	1·25	1·00	4·00	6·88	9·42	2·74	46·06
1915	4·00	3·31	4·44	1·75	3·65	1·02	1·72	0·10	1·30	11·15	6·35	7·81	46·59

Snowfall in Feb., 1914, 1·0 in. Total in 1915, 8·0 in., all in Dec.

ALKALI LAKE

10

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	......	......	......	......	......	......	......	......	0·07	0·93	1·32	0·73	......
1911	0·87	0·26	......	......	1·00	0·63	1·34	2·22	2·09	0·60	1·46	0·80	......
1912	0·42	0·13	0·22	1·20	0·67	1·64	2·28	3·46	0·64	1·07	0·60	0·13	12·46
1913	0·68	0·14	0·37	0·10	0·84	4·17	1·80	2·53	1·69	0·42	0·55	0·00	13·29
1914	1·50	2·53	0·09	0·34	0·90	1·73	0·60	0·80	1·62	0·07	1·01	0·75	11·94
1915	0·53	0·28	0·38	0·35	1·99	2·62	2·76	0·52	0·74	......	0·10	0·53	......
Means	0·74	0·67	0·27	0·50	1·08	2·16	1·76	1·91	1·14	0·62	0·83	0·49	12·17

During 1910-15 (complete record for 1912-14), average monthly snowfall was: Jan., 7·7 in.; Feb., 6·4; Mar., 1·3; April, 0·3; Nov., 3·8; Dec., 4·0. Mean annual snowfall, 23·5 in.; **maximum recorded, 25·3 in., Feb., 1914.**

* This station was established on Beaver creek, near Alberni, in 1894, and discontinued in 1900. See also Alberni (Beaver Creek P.O.).

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

ALOUETTE (LILLOOET) LAKE—Elevation, 400 ft.

11 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1911	......	......	......	......	......	......	......	2·12	8·36	2·77	18·66	13·15	......
1912	11·53	9·66	1·64	6·23	3·93	4·31	3·03	8·04	2·61	8·77	19·02	14·89	93·…
1913	11·69	9·59	12·82	6·47	7·14	6·99	3·54	3·42	6·18	10·87	18·04	8·76	105·…
1914	17·26	7·22	8·20	8·21	3·23	5·35	0·90	0·86	11·31	9·91	19·41	3·98	95·…
1915	11·30	7·82	6·61	8·47	7·33	2·14	2·1[illegible]	0·44	2·77	16·43	11·02	17·30	93·…
Means	12·97	8·57	7·32	7·34	5·41	4·70	2·40	2·98	6·25	9·75	17·23	11·62	96·…

Snowfall in Nov., 1911, 20·5 in.; Dec., 12·3. In Jan., 1912, 12·0; Dec., 2·0; total in 1912, 14·0. In Ja… 1913, 95·8; Mar., 8·0; total in 1913, 103·8. In Nov., 1915, 0·5; Dec., 1·5; total in 1915, 2·0 in.

ALVASTON—Elevation, 1,325 ft.

12 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1915	......	......	......	......	......	1·26	1·64	0·55	0·77	1·32	0·90	1·22	......

Snowfall in Nov., 1915, 5·5 in.; Dec., 9·9 in.

ANNIS (CANOE POINT)—Elevation, 1,160 ft.

13 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1910	......	......	......	......	......	1·04	1·36	1·16	0·91	4·13	2·29	3·68	......
1911	3·57	2·31	1·27	0·85	1·17	1·14	1·68	1·11	1·89	0·31	5·48	3·51	24·…
1912	3·50	1·31	0·08	1·22	1·97	1·91	2·80	1·86	1·29	1·67	2·33	1·49	21·…
1913	4·91	1·20	0·68	0·44	1·55	3·92	2·03	1·27	2·18	2·19	1·62	0·33	22·…
1914	3·51	1·99	1·25	1·14	1·15	2·05	0·72	0·44	2·27	1·90	3·22	1·26	20·…
1915	2·18	0·37	1·00	2·06	2·76	4·21	3·11	1·20	1·36	2·24	1·23	2·86	24·…
Means	3·53	1·44	0·86	1·14	1·72	2·38	1·95	1·17	1·65	2·07	2·67	2·19	22·…

During 1910-15 (1910 incomplete), average monthly snowfall was: Jan., 27·7 in.; Feb., 8·8; Mar., 1·1; No… 5·0; Dec., 15·0. Mean annual snowfall, 57·6 in.; maximum recorded, 49·1 in., Jan., 1913.

ARMSTRONG—Elevation, 1,190 ft.

14 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1912	2·62	1·37	0·06	1·20	0·52	1·92	1·94	1·36	0·95	1·76	3·35	2·18	19·…
1913	3·25	1·67	0·42	0·35	1·33	4·59	1·77	1·62	0·90	2·48	1·61	0·75	20·…
1914	2·81	1·56	0·66	1·01	1·34	1·20	0·98	0·23	2·31	1·65	2·37	0·55	16·…
1915	1·99	0·64	0·93	1·50	2·95	3·26	2·27	0·84	1·48	1·67	1·09	2·14	20·…
Means	2·67	1·31	0·52	1·02	1·54	2·74	1·74	1·01	1·42	1·89	2·11	1·41	19·…

During 1912-15, average monthly snowfall was: Jan., 23·0 in.; Feb., 6·5; Mar., 0·6; Nov., 7·5; Dec., 10… Mean annual snowfall, 48·2 in.; maximum, 32·5 in., Jan., 1913.

ASHCROFT (PROVINCIAL STATION)—Elevation, 1,000 ft.

15 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1912*	......	......	......	......	......	......	......	......	0·48	0·74	0·50	0·37	......
1913*	0·40	0·47	0·00	0·11	0·41	0·70	0·73	2·04	......	......	......	......	......
1914	......	......	......	......	......	......	......	......	......	0·31	0·46	0·00	......
1915	0·80	0·21	0·32	0·03	2·19	1·42	2·15	0·98	0·25	0·47	0·35	1·12	10·…

* The Figures for 1912 and 1913 were obtained from the head office, Dominion Meteorological Service.

Snowfall in Dec., 1912, 3·7 in. In Jan., 1913, 4·0; Feb., 2·3. In Nov., 1914, 1·5; Dec., 0·0. In Jan., 19… 2·0; Feb., 1·0; Dec., 5·7; total in 1915, 8·7 in.

ASPEN GROVE—Elevation, 3,200 ft.

16 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1913	......	......	......	......	......	......	......	0·18	1·23	0·60	2·25	0·45	......
1914	4·46	1·00	1·40	0·65	2·00	0·00	0·00	0·00	1·25	1·[illegible]	1·51	0·90	14·…
1915	1·48	0·65	0·78	0·90	2·57	1·48	2·04	0·23	1·01	1·58	2·17	1·94	16·…

Snowfall in Nov., 1913, 18·0 in.; Dec., 4·5. In Jan., 1914, 23·5; Feb., 10·0; Mar., 14·0; April, 3·0; No… 9·5; Dec., 9·0; total in 1914, 69·0. In Jan., 1915, 14·8; Feb., 6·5; Mar., 2·5; April, 2·2; Nov., 19·5; De… 16·4; total in 1915, 61·9 in.

ATHALMER—Elevation, 2,620 ft.

17 — Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu…
1905	......	......	......	......	......	......	......	......	......	......	......	0·20	......
1906	0·45	0·25	0·15	0·99	2·72	1·99	0·48	1·46	0·41	1·03	0·67	......	......
1907	......	......	......	......	......	......	......	......	......	......	......	......	......
1908	......	......	......	......	......	......	......	......	0·78	1·13	0·58	0·50	......
1909	1·19	0·51	0·33	0·37	0·85	1·31	1·49	1·11	......	......	......	......	......

Snowfall in Dec., 1905, 2·0 in. In Jan., 1906, 4·5; Feb., 2·5; Mar., 1·5; Nov., 3·4. In Oct., 1908, 5·… Nov., 1·0; Dec., 5·0. In Jan., 1909, 5·9; Feb., 4·2; Mar., 0·2; April, 1·6 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

ATLIN—Elevation, 2,240 ft.

18

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1905	......	......	......	......	......	......	......	......	1·06	0·48	1·55	0·76	....
1906	1·37	0·72	0·00	......	0·25	1·74	1·62	0·71	0·78	1·45	2·55	0·88	12·07
1907	0·99	2·18	0·55	0·09	0·34	0·32	0·42	1·48	0·58	0·82	2·34	0·51	10·62
1908	1·08	0·60	1·76	0·08	0·14	0·89	0·21	0·80	1·96	1·49	1·48	0·95	11·44
1909	0·33	0·53	2·12	0·36	0·49	0·51	1·92	1·82	2·54	1·37	0·70	0·28	12·97
1910	0·68	0·88	1·30	0·88	1·06	1·28	2·11	1·03	0·57	0·62	0·73	1·17	12·31
1911	0·75	1·35	1·17	0·10	0·16	0·74	0·41	1·69	1·96	0·59	1·12	1·68	11·72
1912	0·80	0·37	0·08	0·26	0·17	0·26	0·50	1·77	0·51	1·25	0·60	1·39	7·96
1913	1·63	0·62	0·20	0·38	0·28	0·52	1·11	1·27	1·16	1·46	0·86	3·10	12·59
1914	0·70	1·18	0·90	1·19	0·56	0·27	0·66	0·47	2·06	1·02	0·92	0·28	10·21
1915	0·47	0·90	0·32	0·21	0·99	0·74	1·14	0·37	0·14	1·60	0·32	1·25	8·45
Means	0·88	0·93	0·84	0·39	0·44	0·73	1·01	1·14	1·21	1·10	1·20	1·11	10·98

During 1905-15 (1905 and 1906 incomplete), average monthly snowfall was: Jan., 8·7 in.; Feb., 9·[illegible] Mar., 6·2; April, 3·3; May, 0·3; June, 0·3; Sept., 1·8; Oct., 6·3; Nov., 9·1; Dec., 10·4. Mean annual [illegible]all, 55·5 in.; maximum re[illegible]ded, 30·3 in., Dec., 1913.

AYANSH—Elevation, near sea-level

19

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	1·15	4·41	1·52	3·65	3·85	6·11	1·21	....
1915	4·51	1·31	1·25	1·46	1·25	4·54	2·11	0·99	1·71	7·87	2·80	1·66	31·46

Snowfall in Nov.; 1914, 18·0 in.; Dec. 12·0. In Jan., 1915, 7·5; Feb., 0·0; Nov., 9·5; Dec., 1·3; total in 1915, 24 3 in.

BABINE LAKE—Elevation, 2,230 ft.

20

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1908	......	......	......	......	......	......	......	......	......	5·34	2·35	1·15	....
1909	1·80	1·28	0·70	......	......	......	......	2·48	1·50	1·96	2·70	1·20	....
1910	1·85	1·05	1·47	0·94	5·01	2·98	1·13	2·64	1·96	2·85	4·18	2·70	28·36
1911	2·83	1·20	0·97	......	......	......	......	......	......	......	......	......	....
1912	......	......	......	......	......	......	......	......	1·66	0·15	0·70	0·70	....
1913	2·25	1·55	1·65	1·90	......	......	......	......	......	1·87	0·85	1·45	....
1914	2·00	0·80	1·60	3·86	0·20	0·40	0·05	......	0·90	1·20	1·00	0·60	....
1915	0·90	0·30	0·45	......	......	......	......	......	4·75	2·41	1·50	0·70	....
Means	1·94	1·03	1·14	2·23	2·90	1·69	0·59	2·56	2·14	2·26	1·90	1·21	21·59

During 1908-15 (complete records for 1 year only), average monthly snowfall was: Jan., 18·9 in.; Feb, 9·5 Mar., 8·6; April, 6·5; Oct., 6·1; Nov., 16·1; Dec., 11·4. Mean annual snowfall, 77·1 in; maximum recorded, 41·8 in, Nov., 1910.

BANFIELD—Elevation, 50 ft.

21

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1903	......	5·26	5·28	8·09	7·97	5·61	2·12	1·99	......	13·15	25·36	11·45	....
1904	14·43	23·69	11·47	10·20	2·65	1·87	1·42	0·04	2·74	......	29·15	33·71	....
1905	4·49	11·36	10·55	1·55	2·47	0·15	T	1·54	9·23	5·04	2·76	7·50	56·64
1906	10·94	4·93	2·75	2·99	1·02	2·78	0·05	0·84	9·58	8·14	10·41	10·51	64·94
Means	9·95	11·31	7·51	8·71	3·53	2·60	0·90	1·10	7·18	8·78	16·92	15·79	91·28

Snowfall in Mar., 1903, 3·0 in.; Oct., 0·2. In Jan., 1904, 3·5; Feb., 12·0; Mar., 5·0; Nov., 4·0; Dec., 24·5. In Jan., 1905, 0·1; Oct., 1·0; total in 1905, 1·1. In Jan., 1906, 2·9; Dec., 0·0; total in 1906, 2·9 in.

BARKERVILLE—Elevation, 4,180 ft.

22

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1888	3·40	4·71	2·78	5·15	1·39	4·02	3·46	3·28	2·30	4·12	2·63	3·47	41·01
1889	2·50	3·00	1·55	1·66	3·70	2·16	0·32	4·25	3·24	1·03	1·90	3·40	28·71
1890	1·25	2·05	3·80	3·73	3·80	2·46	3·85	4·25	3·05	2·35	3·15	4·52	38·26
1891	2·60	1·60	2·30	1·15	1·05	4·35	3·70	2·00	4·66	2·35	4·83	4·20	34·79
1892	6·40	1·00	1·12	1·26	......	2·22	7·40	3·72	6·73	3·01	3·53	4·20	....
1893	2·67	2·20	1·20	2·15	3·75	5·27	2·79	3·65	2·97	5·63	3·60	5·10	40·98
1894	2·60	1·70	1·40	2·76	2·01	4·02	1·09	1·79	3·93	1·07	3·02	1·80	27·19
1895	2·90	5·20	0·70	0·30	2·58	1·97	2·04	2·40	1·98	0·51	5·28	6·28	32·14
1896	2·31	2·90	2·20	0·80	2·18	1·95	0·16	1·75	0·99	1·77	2·30	1·30	20·61
1897	1·00	2·50	2·20	0·39	2·59	2·55	5·56	1·19	0·00	2·99	2·80	2·00	25·77
1898	2·50	4·10	1·80	1·50	1·23	5·68	......	0·58	3·87	2·76	3·50	1·30	....
1899	1·79	4·09	2·18	1·78	3·09	2·74	3·10	2·88	2·96	2·22	2·06	2·36	31·25
1900	1·82	4·30	0·76	0·76	2·84	5·91	2·78	8·50	2·00	3·20	3·14	1·60	39·61
1901	4·40	1·22	2·90	1·86	3·17	4·00	3·38	0·94	3·52	2·26	3·90	4·20	35·75
1902	1·80	1·80	1·90	2·18	4·34	3·56	2·98	3·46	3·70	0·91	4·10	1·50	32·23
1903	1·40	0·46	1·95	2·86	2·78	3·58	3·77	6·42	7·74	0·76	1·00	2·20	34·92
1904	5·40	4·30	2·70	1·15	1·59	2·54	2·13	1·30	3·06	3·40	0·92	3·56	32·05
1905	2·00	1·76	1·60	2·18	2·34	4·14	2·20	4·21	2·08	3·62	3·74	2·80	32·67
1906	3·40	0·60	0·71	2·38	1·00	3·00	2·14	1·30	7·46	6·32	3·46	5·86	37·63
1907	......	......	0·00	0·16	1·06	2·90	6·40	5·24	3·25	1·49	4·04	4·30	....
1908	2·50	3·33	5·75	2·91	2·29	4·52	3·72	6·29	2·60	5·25	4·43	2·95	49·54
1909	2·37	3·72	1·40	3·62	1·62	1·86	2·81	3·68	4·93	3·99	4·42	3·39	37·41

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

BARKERVILLE—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1910	3·30	2·29	1·30	1·50	2·53	3·56	2·96	3·27	2·17	4·28	3·15	3·40	33·
1911	5·90	2·05	4·10	2·07	1·86	4·12	2·12	2·84	3·62	0·84	2·99	3·80	36·
1912	0·86	1·34	1·10	2·25	1·81	2·50	3·42	4·24	1·14	3·21	2·35	6·01	30·
1913	7·50	1·60	4·15	1·85	3·13	1·99	2·15	5·54	5·98	4·53	5·26	1·65	45·
1914	4·60	3·60	2·55	2·28	3·22	4·39	4·69	0·96	3·75	2·19	4·51	3·10	39·
1915	0·77	1·74	0·91	2·62	3·74	5·27	4·90	2·47	2·68	5·20	3·05	4·85	38·
Means	2·97	2·56	2·04	1·98	2·47	3·46	3·10	3·30	3·44	2·97	3·32	3·39	35·

During 1887-1915 (4 years incomplete), average monthly snowfall was : Jan , 26·2 in.; Feb., 25·0 ; Mar., 18· April, 13·6; May, 3·0 ; June, 0·7 ; Aug., 0·1 ; Sept., 1·7 ; Oct., 9·8 ; Nov., 26·3 ; Dec., 33·8. Mean ann snowfall, 158·6 in.; maximum recorded, 62·0 in., Jan., 1892.

BAYNES LAKE—Elevation, 2,800 ft.

23

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1915	1·28	0·32	0·54	1·41	1·62	3·62	1·74	0·32	3·11	......	1·75	2·08	.....

Snowfall in Jan., 1915, 12·8 in.; Feb., 2·3 ; Nov., 7·0 ; Dec., 19·4 in.

BEVAN—Elevation, '40 ft.

24

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1914	......	......	......	......	......	......	......	0·91	7·45	13·26	11·71	4·01	.....
1915	8·01	7·63	5·02	2·96	4·71	1·04	1·42	0·08	1·49	14·21	11·97	18·59	77·

Snowfall in Nov., 1914, 14·0 in. In Feb., 1915, 2·5 Nov., 8·5 ; Dec., 19·4 ; total in 1915, 30·4 in.

BELLAKULA—Elevation, 150 ft.

25

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1898	......	2·45	......	......	......	0·91	0·29	0·43	1·30	2·51	5·85	......	.....
1899	2·80	3·30	2·60	0·20	0·05	1·63	3·80	2·53	1·86	4·73	1·30	1·15	25·
1900	3·31	5·51	1·28	1·96	2·78	1·85	1·34	2·27	1·33	......	......	3·37	.....
1901	4·70	1·05	2·83	3·00	2·43	1·09	2·78	1·74	0·50	8·99	10·00	9·75	48·
1902	5·57	2·01	3·54	0·86	1·80	1·91	2·72	2·75	3·93	3·59	1·69	5·63	36·
1903	2·05	0·00	0·27	1·23	1·14	2·88	1·52	2·41	6·92	8·74	9·58	6·41	43·
1904	5·82	3·50	0·50	3·55	0·55	1·93	1·17	0·17	5·04	5·83	7·76	6·10	41·
1905	2·06	2·85	3·57	0·96	0·95	0·59	......	......	......	......	......	......	.....
1906	......	......	......	1·44	......	1·91	0·83	2·23	10·66	12·72	3·95	6·05	.....
1907	1·58	4·18	1·45	2·15	1·53	1·56	1·01	2·96	3·21	5·37	11·63	3·82	40·
1908	1·48	3·98	6·97	3·74	2·03	1·61	2·74	0·73	6·15	4·13	4·40	4·96	42·
1909	2·90	2·80	1·23	0·76	2·57	1·54	1·72	3·89	4·04	7·16	6·81	2·34	37·
1910	6·55	3·17	8·03	1·99	1·77	2·81	1·28	1·94	2·47	6·58	5·67	4·46	46·
1911	3·62	1·68	3·80	1·37	1·26	1·48	0·93	1·59	2·13	4·71	6·79	7·00	36·
1912	5·79	1·93	0·71	1·76	0·76	0·61	1·25	1·17	0·85	5·04	8·34	6·90	35·
1913	6·68	2·74	3·67	2·64	4·37	3·31	1·07	1·77	8·15	12·42	9·35	6·99	63·
1914	5·17	2·95	8·88	2·85	2·22	1·30	3·31	0·89	4·52	4·59	12·95	0·98	50·
1915	1·78	1·53	1·22	2·44	2·66	1·26	2·21	1·30	2·12	12·40	3·87	5·08	37·
Means	3·87	2·68	3·16	1·94	1·80	1·68	1·76	1·81	3·84	6·84	6·87	5·06	41·

During 1898-1915 (5 years incomplete), average monthly snowfall was : Jan., 18·7 in.: Feb., 12·6 ; Mar., 6· April, 1·5 ; Oct., 0·5 ; Nov., 6·3 ; Dec., 8·0. Mean annual snowfall, 54·2 in.; maximum recorded, 38·5 in., Ja 1913.

BIRCHBANK—Elevation, 1,400 ft.

26

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1913	......	......	......	......	......	......	......	......	1·02	1·43	5·52	1·15	.....
1914	6·91	1·91	1·38	3·11	1·65	1·74	0·65	0·00	2·94	2·34	4·26	1·20	28·
1915	0·90	2·37	2·13	3·16	4·12	1·55	3·89	0·04	0·24	2·05	4·85	5·07	30·

Snowfall in Dec., 1913, 8·0 in. In Jan., 1914, 26·0 ; Feb., 12·5 ; Nov., 3·0 ; Dec., 12·0. In Jan., 1915, 9· Feb., 15·0 ; Nov., 40·3 ; Dec., 18·6 ; total in 1915, 82·9 in.

BONNINGTON FALLS—Elevation, 1,650 ft.

27

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1913	......	......	......	......	......	......	......	......	1·71	7·24	1·36	2·21	.....
1914	3·20	1·75	1·66	1·66	0·08	3·34	2·33	5·84	0·52	1·67	4·99	0·95	27·
1915	1·25	1·00	1·20	3·03	4·13	2·23	2·72	0·07	0·70	1·72	2·20	2·60	22·

Snowfall in Nov., 1913, 8·0 in. ; Dec., 5·2. In Jan., 1914, 27·7 ; Feb., 6·5 ; Mar., 5·2 ; Nov., 3·0 ; Dec., 9· total in 1914, 51·9. In Jan., 1915, 12·5 ; Feb., 10·0 ; Nov., 22·0 ; Dec., 26·0 ; total in 1915, 70·5 in.

BOSWELL—Elevation, 1,780 ft.

28

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1911	......	......	0·99	0·47	2·01	1·60	......	......	......	......	......	......	.....
1914	......	......	1·83	0·43	0·69	1·54	0·98	0·30	2·53	2·09	4·11	1·76	.....
1915	1·35	0·93	0·95	2·11	3·49	2·28	5·21	0·32	1·45	1·68	3·20	3·81	26·

Snowfall in Mar., 1911, 2·5 in.; April, 3·9. In Mar., 1914, 10·5 ; Nov., 1·5 ; Dec., 11·9. In Jan., 1915, 13· Feb., 3·3 ; Nov., 15·4 ; Dec., 22·5 ; total in 1915, 51·7 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

BRIDGE RIVER (ABOVE CAÑON)—Elev[illegible]on, 1,800 ft.

29 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	1·87	1·20	2·93	2·61	3·33	3·60	.....
1914	3·18	2·74	1·74	0·70	1·47	2·01	0·14	0·07	4·22	1·17	6·46	0·73	24·63
1915	0·77	1·08	0·47	0·43	1·78	1·62	1·38	0·62	0·22	4·20	1·04	1·96	15·57

Snowfall in Nov., 1913, 19·5 in; Dec., 7·0. In Jan., 1914, 0·0 ; Feb., 15·0 ; Nov., 15·0 ; Dec., 4·5 ; total in 1914, 34·5 in.

BRISCO (40-MILE) (PROVINCIAL STATION)—Elevation, 2,600 ft.

30 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	2·47	0·71	1·74	0·52	.....
1914	2·64	0·80	0·44	1·21	1·49	2·22	1·00	0·92	2·53	1·11	1·83	0·44	16·63
1915	0·52	0·41	0·34	1·10	1·54	4·70	4·67	0·59	1·01	1·14	0·92	2·60	19·54

Snowfall in Oct., 1913, 0·5 in.; Nov., 1·5 ; Dec., 5·2. In Jan., 1914, 9·7 ; Feb., 4·9 ; Mar., 1·7 ; Nov., 3·4 ; Dec., 4·4 ; total in 1914, 24·1. In Jan., 1915, 5·2 ; Feb., 1·1 ; Mar., 2·4 ; Sept., 4·0 ; Nov. 5·4 ; Dec., 15·7 ; total in 1915, 36·8 in.

BRITANNIA BEACH—Elevation, about 165 ft.

31 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6·21	.....
1914	16·85	3·80	6·58	5·32	1·48	2·08	0·48	0·77	8·25	14·41	14·94	2·45	77·41
1915	7·83	6·84	5·17	5·77	4·47	1·35	1·60	0·54	1·64	14·56	7·09	15·60	72·46

Snowfall in Dec., 1913, 3·1 in. In Jan., 1914, 19·3 ; Feb., 2·0 ; Mar., 2·5 ; total in 1914, 23·8. In Jan., 1915, 0·8 ; Dec., 12·8 ; total in 1915, 13·6 in.

BRITANNIA (TUNNEL)—Elevation, 2,200 ft.

32 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	2·10	0·85	1·02	12·00	19·38	12·01	0·70	.....
1915	10·79	20·41	10·35	10·14	7·11	1·57	2·44	0·12	1·64	18·11	4·95	20·13	107·76

Snowfall in Nov , 1914, 36·0 in.; Dec., 3·5. In Jan., 1915, 29·2 ; Feb., 18·5 ; Nov., 20·0 ; Dec., 36·0 ; total in 1915, 103·7 in.

BRITAN[illegible]NE)—Elevation, 3,700 ft.

33 [illegible]ECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	[illegible]24	1·11	0·99	12·73	20·89	16·32	3·25	.....
1915	6·65	6·60	.....	.....	.....	..	3·77	0·03	2·99	18·01	8·64	.....	.....

Snowfall in Nov., 1914, 43·6 in; Dec., 30·5. In Jan., 1915, 66·5 in.; Feb., 61·0 ; Oct., 6·5 ; Nov., 69·7 in.

BUNTZEN LAKE—Elevation, 400 ft.

34 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1903	18·89	5·20	6·90	7·37	6·32	5·58	3·33	2·30	15·26	16·25	24·19	9·85	121·44
1904	20·66	13·61	11·46	5·18	3·80	3·05	3·30	1·08	5·25	7·29	20·93	13·73	109·34
1905	14·10	11·23	15·72	5·34	6·02	4·30	2·12	1·85	20·69	9·40	9·21	16·16	116·14
1906	21·44	11·45	2·57	2·39	10·32	8·94	0·79	1·79	24·05	24·57	14·95	14·35	137·61
1907	16·40	13·86	7·25	10·10	2·46	3·02	1·61	3·38	6·75	1·34	25·98	14·44	106·59
1908	12·52	9·68	17·12	8·07	5·85	2·70	3·50	0·30	5·65	13·81	24·64	8·33	112·17
1909	13·17	10·90	5·69	5·51	6·69	4·52	3·64	6·26	4·85	14·30	22·63	7·59	105·75
1910	8·20	12·03	11·38	12·01	4·54	4·02	0·25	5·92	3·27	15·62	19·51	17·75	114·50
1911	10·10	6·44	9·41	2·26	9·18	2·99	1·03	1·39	10·10	3·65	20·45	21·60	98·60
1912	15·94	10·13	3·02	6·74	3·23	4·62	2·58	8·25	4·74	11·40	19·08	19·04	108·77
1913	17·39	8·89	9·28	5·28	7·31	6·37	3·48	2·44	6·25	10·44	21·26	8·54	106·93
1914	19·29	7·82	8·04	5·08	3·38	4·69	0·80	1·13	10·99	15·25	18·90	3·59	98·96
1915	11·22	7·03	7·97	5·70	5·78	0·44	2·03	0·73	1·46	19·36	10·12	19·64	91·48
Means	15·33	9·87	8·91	6·23	5·76	4·25	2·19	2·83	9·18	12·51	19·37	13·43	109·86

BUTE INLET (SOUTHGATE RIVER)—Elevation, near sea-level

35 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	.....	.....	.....	4·09	11·64	16·01	3·42	.....
1915	4·69	5·30	4·24	5·96	1·48	0·89	2·26	2·08	0·66	15·92	8·59	12·13	64·20

Snowfall in Nov., 1914, 3·0 in.; Dec., 23·8. In Jan., 1915, 2·9 ; Dec., 31·7 ; total in 1915, 34·6 in.

CACHE CREEK—Elevation, 1,250 ft.

36 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	1·71	0·15	0·52	0·71	.....	.....
1914	0·92	1·40	0·03	0·33	0·57	0·98	0·75	0·00	0·26	0·15	0·15	0·27	5·81
1915	0·37	0·15	0·37	0·04	1·99	1·09	1·10	0·07	0·00	0·01	0·16	0·02	5·37

Snowfall in Jan., 1914, 3·0 in.; Feb., 13·0 ; Dec., 2·5 ; total in 1914, 18·5. Total in 1915, 2·5 in., all in Jan.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

CAMERON LAKE—Elevation, about 640 ft.

37

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8·12	2·38	.....
1915	5·51	5·54	4·50	4·80	3·19	0·46	0·81	0·14	1·34	13·19	9·26	9·28	58·[illegible]

Snowfall in Nov., 1914, 6·0 in.; Dec., 0·7. In Jan., 1915, 0·1 ; Feb., 0·1 ; Dec., 0·1 ; total in 1915, 0·3 i[n.]

CAMPBELL RIVER*—Elevation, 80 ft.

38

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1910	.....	.....	.....	.....	3·51	1·53	0·30	0·68	1·20	7·55	11·70	13·01	.....
1911	7·16	5·38	0·70	1·34	4·13	1·03	0·81	1·22	2·23	1·85	10·63	9·24	45·7
1912	8·13	4·80	0·31	2·44	3·32	1·72	0·73	3·45	3·48	6·33	8·63	12·28	58·7
1913	7·65	2·23	3·00	2·04	1·38	3·23	2·81	1·30	4·05	5·57	12·27	5·22	50·7
1914	1[illegible]	4·34	5·71	4·35	1·15	.....	.....	.....	.....	.....	.....	.....	.....
Means	10·48	4·19	2·43	2·54	2·70	1·88	1·16	1·66	2·74	5·32	10·81	9·94	55·[illegible]

* Records by Campbell River Power Co

CANALFLAT—Elevation, 2,656 ft.

39

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1913	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·03	0·83	.....
1914	3·32	0·90	1·53	3·53	1·97	2·30	2·52	0·63	1·43	3·84	1·85	2·05	25·8
1915	2·60	0·60	0·33	1·16	1·51	3·45	2·67	0·09	2·37	1·87	3·65	2·[illegible]	22·8

Snowfall in Nov., 1913, 8·3 in.; Dec., 8·3. In Jan., 1914, 32·0 ; Feb., 9·0 ; Mar., 13·0 ; Nov., 15·5 ; De[c.], 20·5 ; total in 1914, 90·0. In Jan., 1915, 26·0 ; Feb., 6·0 ; Sept., 2·0 ; Nov., 28·5 ; Dec., 24·0 ; total in 191[5], 86·5 in.

CANOBIE—Elevation, 190 ft.

40

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1895	7·86	3·56	4·57	3·49	3·87	0·26	0·65	0·13	1·74	0·15	4·74	13·54	44·5
1896	13·69	9·14	2·59	1·84	2·14	1·62	T	0·44	0·94	4·21	13·67	10·80	61·0

Snowfall in Jan., 1895, 11·5 in. : Feb., 0·0 ; Mar., 1·9 ; Dec., 14·3 ; total in 1895, 27·7. In Jan., 1896, 31· Feb., 3·5 ; Mar., 3·8 ; Nov., 16·0 ; total in 1896, 54·8 in.

CAPILANO INTAKE—Elevation, 480 ft.

41

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1914	.....	.....	.....	.....	.....	.....	0·70	2·14	13·14	18·92	22·23	4·96	.....
1915	16·33	8·77	13·23	10·71	5·65	0·76	2·23	0·26	1·36	23·86	12·79	20·07	116·0[illegible]

Snowfall in Nov., 1914, 1·0 in. Snowfall in 1915, 14·5 in., all of which fell in Dec.

CARMANAH—Elevation, 130 ft.

42

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1892	9·76	5·79	13·13	8·93	4·68	1·67	3·18	3·53	4·65	7·15	14·43	10·07	86·9[illegible]
1893	9·28	9·95	12·16	14·03	7·37	1·48	1·32	0·75	5·08	6·78	17·36	16·19	101·7[illegible]
1894	11·09	17·07	16·33	15·05	4·77	2·34	1·44	0·12	16·36	16·93	16·61	9·98	128·1[illegible]
1895	14·38	10·75	12·85	11·32	7·93	3·41	3·44	0·20	8·83	2·27	16·27	27·34	118·9[illegible]
1896	26·23	28·08	7·02	14·06	7·41	6·25	T	1·10	0·64	7·93	17·00	23·73	139·4[illegible]
1897	12·79	12·90	10·58	12·52	3·94	3·36	5·64	1·29	3·98	9·05	13·08	20·31	109·4[illegible]
1898	11·24	17·93	2·21	4·89	2·17	5·11	1·27	0·80	5·60	6·98	13·96	12·75	84·91
1899	17·06	16·71	7·04	9·76	8·09	1·55	0·51	0·94	3·40	9·12	28·95	17·30	120·4[illegible]
1900	12·80	11·34	8·41	8·11	6·15	11·38	2·05	2·36	1·42	14·56	11·62	23·66	113·8[illegible]
1901	8·19	9·25	2·94	8·33	11·34	3·48	0·80	0·80	6·10	6·84	20·68	16·08	94·8[illegible]
1902	10·82	21·20	11·87	1·63	3·07	4·45	.....	.....	.....	.....	.....	.....	.....
Means	13·06	14·63	9·50	9·88	6·08	4·04	1·97	1·19	5·61	8·76	17·00	17·75	109·47

During 1892-1902 (1902 incomplete), average monthly snowfall was : Jan., 5·5 in.; Feb., 5·7 ; Mar., 2·0 April, 0·3 ; Nov., 2·6 ; Dec., 2·0. Mean annual snowfall, 18·1 in.; maximum, 41·0 in., Feb., 1893.

CARMI—Elevation, 2,780 ft.

43

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1913	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·91	1·90	1·45	.....
1914	3·63	1·75	0·86	1·18	1·22	1·99	0·36	1·03	1·56	1·82	2·84	2·74	20·98
1915	1·88	1·63	0·65	1·39	4·14	1·83	4·24	0·58	0·26	1·22	2·18	2·13	22·13

Snowfall in Oct., 1913, 10·6 in ; Nov., 8·8 ; Dec., 14·5. In Jan., 1914, 24·0 ; Feb., 17·5 ; Mar., 6·0 ; April 3·7 ; Nov , 15·3 ; Dec , 27·2 ; total in 1914, 93·7. In Jan., 1915, 18·8; Feb., 12·0 ; Mar., 4·0 ; Nov., 14·9 Dec., 17·5 ; total in 1915, 37·2 in.

CAULFIELD—Elevation, 30 ft.

44

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1902	6·64	8·79	7·57	2·96	4·20	3·81	3·30	0·99	3·18	4·48	10·53	8·80	65·25
1903	6·65	2·36	4·50	2·42	.....	.....	.....	.....	.....	.....	.....	.....	.....

Snowfall in Jan., 1902, 17·7 in.; Feb., 1·5 ; Mar., 1·0 ; total in 1902, 20·2. In Jan., 1903, 1·5 ; Feb., 0·5 Mar., 14·5 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

45 CHILCOTIN (BIG CREEK)—Elevation, 3,100 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1892												5·70	
1893	....	1·62	0·65	....	....	1·59	1·64	....	0·50	1·56	1·17	....	....
1894	....	....	....	1·07	0·13	2·35	1·44	1·35	1·31	1·21	1·08	0·55	....
1895	0·90	....	....	0·14	0·75	0·74	1·16	0·27	....	....	....	....	....
1896	....	1·05	0·37	0·67	....	....	0·02	0·29	0·70	0·52	3·13	0·42	....
1897	1·50	0·55	1·10	....	....	....	2·40	0·59	....	....	....	....	....
1898	0·52	1·10	0·66	0·16	....	....	0·31	0·53	....	....	....	....	....
1899	....	....	....	....	....	....	....	....	....	....	0·69	0·66	....
1900	0·45	0·97	0·49	0·53	....	....	....	....	....	....	....	....	....
.....	....	....	....	....	....	....	....	....	....	....	....	....	....
1904	1·00	0·70	1·03	0·77	0·32	0·81	0·43	0·35	0·07	0·60	0·30	0·78	7·16
1905	0·23	0·10	0·15	0·49	1·05	1·35	1·30	1·17	0·54	0·41	3·04	0·90	10·73
1906	0·43	0·20	0·35	0·08	2·64	1·01	1·73	0·33	1·56	0·79	0·60	2·20	11·92
1907	0·70	0·37	0·83	0·19	0·55	1·12	1·53	3·04	1·06	0·06	0·60	0·60	10·65
1908	0·80	1·43	0·92	0·86	1·97	3·22	1·71	1·05	0·51	0·75	0·53	0·45	14·20
1909	0·80	0·80	0·20	0·24	1·34	1·05	1·25	1·16	1·93	0·88	1·48	0·80	11·93
1910	0·55	1·80	0·19	0·12	1·02	1·53	0·66	2·42	1·18	0·62	0·91	1·09	12·00
1911	0·95	0·45	0·33	0·43	0·86	1·80	0·33	4·10	3·52	0·10	2·55	1·25	16·67
1912	0·25	0·20	0·10	0·56	0·43	1·94	2·82	3·41	1·25	1·13	0·42	0·40	12·91
1913	0·70	1·40	0·73	0·21	0·68	2·54	2·03	3·32	0·79	1·23	0·65	0·20	14·50
1914	1·03	2·05	0·48	0·28	0·72	3·77	0·70	0·24	1·85	0·02	1·25	0·40	12·81
1915	0·05	0·50	0·23	0·85	2·19	1·65	3·15	1·00	1·35	0·56	0·35	1·10	13·07
Means	0·68	0·90	0·53	0·45	1·05	1·76	1·37	1·45	1·21	0·70	1·17	1·09	12·36

During 1895-1915 (1904-15 complete), average monthly snowfall was: Jan., 6·7 in.; Feb., 8·5; Mar., 4·6; April, 2·4; May, 0·9; Oct., 1·8; Nov., 10·2; Dec., 7·6. Mean annual snowfall, 42·7 in.; maximum recorded, 31·3 in., Nov., 1896.

46 CHILLIWACK—Elevation, 21 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	4·34	4·59	3·94	2·00	2·28	0·40	0·71	5·86	1·27	....	6·66	2·84	....
1879	5·29	....	9·03	2·90	4·58	1·79	4·81	2·16	2·67	9·45	6·38	6·21	....
1880	10·03	3·52	4·38	2·06	4·28	0·61	3·30	1·11	2·72	4·50	3·18	9·78	49·42
1881	4·84	10·98	....	....	....	....	....	....	....	....	....	....	....
1882	....	....	....	....	0·50	....	....	....	....	....	6·00	4·50	....
.....	....	....	....	....	....	....	....	....	....	....	....	....	....
1895	....	6·79	3·55	3·55	6·73	1·40	0·52	0·42	6·43	0·78	5·90	11·16	....
1896	13·68	9·27	4·78	4·29	2·73	3·42	0·05	1·73	1·88	4·62	12·81	12·68	71·94
1897	6·41	4·42	4·93	4·84	3·29	6·44	3·81	1·19	3·57	4·10	12·29	11·64	66·93
1898	5·25	10·63	3·32	3·50	1·54	4·07	1·13	0·72	3·63	7·22	9·66	7·30	57·97
1899	8·30	7·96	3·90	4·14	5·37	3·07	1·66	4·38	2·49	5·19	15·18	12·19	73·83
1900	....	....	6·36	4·31	6·26	8·29	....	4·26	2·79	8·32	4·70	9·43	....
1901	7·21	8·15	3·40	7·56	5·18	4·83	1·42	0·04	2·47	4·50	13·74	5·54	64·04
1902	6·82	8·39	5·52	3·77	3·01	1·86	2·60	1·74	4·14	2·84	11·72	9·72	62·13
1903	9·31	1·79	4·28	2·85	4·77	3·83	2·29	2·52	8·83	5·08	12·26	8·20	66·01
1904	6·66	6·39	6·43	3·36	2·71	3·75	1·81	0·72	1·99	3·24	8·05	10·96	56·07
1905	5·84	5·00	5·09	1·53	4·47	2·96	0·57	3·09	9·18	8·39	4·77	5·20	56·09
1906	8·96	4·95	1·25	1·96	4·52	4·09	0·53	1·26	8·85	12·60	10·72	7·67	67·36
.....	....	....	....	....	....	....	....	....	....	....	....	....	....
1910	....	....	....	....	....	2·50	0·19	2·36	1·87	12·62	14·24	9·61	....
1911	9·85	2·78	3·51	2·66	3·58	1·32	1·29	2·09	4·96	1·40	12·87	7·49	53·80
1912	9·27	5·43	1·10	2·13	1·55	2·23	2·17	5·12	1·23	6·70	10·81	7·05	54·79
1913	10·65	6·46	7·46	2·48	3·19	3·82	2·53	2·24	6·35	7·84	10·73	2·36	66·11
1914	14·68	3·27	4·49	3·94	1·97	3·14	0·17	0·45	6·35	4·71	9·87	2·08	55·12
1915	6·90	3·39	2·37	4·33	5·27	1·67	1·10	0·02	1·22	10·03	6·91	10·52	53·73
Means	8·12	6·02	4·45	3·41	3·71	3·12	1·63	2·07	4·04	6·21	9·52	7·91	60·21

During 1879-1915 (complete record for 16 years and partial record for 6 years), average monthly snowfall was: Jan., 18·9 in.; Feb., 4·9; Mar., 4·6; April, 0·3; Nov., 5·3; Dec., 4·6. Mean annual snowfall, 38·6 in.; maximum recorded, 70 5 in., Jan., 1918.

47 CHINOOK COVE (DOMINION STATION)*—Elevation, 1,300 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	3·13	1·88	0·74	0·41	0·54	1·62	0·50	0·44	1·38	1·02	2·18	1·00	14·84
1915	0·75	0·57	0·71	0·40	2·80	3·32	2·76	0·87	1·13	1·05	0·55	1·56	16·47

Snowfall in Jan., 1914, 12·0 in.; Feb., 18·8; Mar., 1·3; Nov., 8·0; Dec, 10·0; total in 1914, 50·1. In Jan., 1915, 7·5; Feb., 0·5; Nov., 3·0; Dec., 10·5; total in 1915, 21·5 in.

49 CHRISTINA LAKE—Elevation, 1,460 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	....	....	....	....	....	....	....	....	1·39	2·30	3·47	1·72	....
1914	6·98	2·28	1·03	2·04	1·11	1·58	0·73	0·10	1·98	1·15	2·61	1·49	23·08
1915	2·19	1·34	1·49	2·51	4·67	1·82	2·44	0·05	0·75	1·98	3·64	3·97	26·85

Snowfall in Oct., 1913, 5·0 in.; Nov., 5·5; Dec., 10·5. In Jan., 1914, 24·2; Feb, 7·5; Mar., 2·0; Nov., 3·5; Dec., 9·5; total in 1914, 46·7. In Jan., 1915, 17·0; Feb., 5·5; Nov., 14·7; Dec., 14·5; total in 1915, 51·7 in.

* As the figures for Precipitation and Snowfall recorded at the Provincial station (Record No. 48) are almost exactly the same as those recorded at the Dominion station, the former have been omitted.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

CLAYOQUOT—Elevation, 40 ft.

50

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1898	......	......	......	......	......	7·84	2·66	0·22	6·02	8·76	13·39	11·68	......
1899	15·16	14·07	7·40	12·52	7·24	1·16	......	......	......	......	......	......	......
1900	2·80	......	No	Recor	ds	......	......	......	3·22	5·95	14·14	22·66	......
1901	11·50	17·84	13·31	12·38	17·63	4·33	4·77	1·52	4·57	10·96	32·87	16·67	148·6
1902	12·07	25·47	17·58	13·46	7·53	6·10	2·89	2·26	5·06	10·77	19·50	23·88	146·5
1903	15·33	6·61	6·72	10·59	7·49	7·13	1·21	2·84	15·94	15·69	25·73	15·07	130·3
1904	15·16	16·90	6·53	7·36	5·76	2·77	3·70	0·00	9·80	15·11	33·75	19·43	136·2
1905	13·79	14·10	23·27	4·26	3·86	0·61	0·23	4·49	10·85	8·60	16·06	21·50	121·6
1906	23·87	6·42	9·93	6·13	2·15	9·56	0·11	4·27	14·33	20·82	13·79	17·54	128·9
1907	14·08	13·11	8·40	11·73	5·80	0·87	0·93	5·09	4·64	4·64	5·98	13·62	88·9
1908	16·24	7·06	18·30	7·28	9·82	1·93	3·55	2·19	6·92	12·21	27·60	9·45	122·5
1909	8·61	12·82	12·48	4·22	2·91	4·71	3·21	15·73	4·63	16·32	17·83	4·37	108·0
1910	26·62	7·69	7·94	9·20	5·69	3·59	0·43	1·24	4·60	18·04	16·06	15·76	116·8
1911	12·40	8·99	6·03	2·05	7·70	4·38	1·17	1·58	3·48	9·49	18·56	16·23	92·2
1912	17·83	17·57	1·75	7·68	3·90	3·92	1·23	4·57	4·73	1·77	18·85	21·36	105·1
1913	13·97	9·70	8·43	11·28	5·78	6·16	3·25	2·09	9·90	8·10	18·95	16·88	114·4
1914	21·55	11·59	13·72	14·08	2·63	3·08	1·05	1·66	9·11	19·44	24·35	7·44	129·7
1915	10·65	10·48	13·23	9·10	7·47	2·44	2·89	2·85	1 77	21·02	14·52	22·61	119·0
Means	14·80	12·53	10·94	8·96	6·46	4·18	2·08	3·29	7·03	12·29	19·51	16·26	118·2

During 1898-1915 (complete record for 12 years), average monthly snowfall was: Jan., 11·0 in.; Feb., 1·
Mar., 2·0; Nov., 1·2; Dec., 0·. Mean annual snowfall, 16·1 in.; maximum recorded, 43·2 in., Jan., 1907.

Snow at this station does not usually remain long on the ground; probably most of the snowfall is recorded rain.

CLINTON—Elevation, 3,040 ft.

51

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1881	1·32	0·32	......	......	......	......	......	......	......	......	......	......	......
1882	0·60	0·25	0·30	0·10	0·24	1·72	0·70	0·71	0·03	0·06	0·45	0·80	5·9
1883	1·35	0·25	T	T	......	......	......	......	......	0·40	0·50	2·50	......
1884	0·42	0·08	0·05	0·08	0·05	1·21	......	0·04	0·07	0·10	0·00	·35	......
1885	0·30	0·85	0·30	0·20	1·25	0·00	......	0·07	0·08	0·03	0·20	0·20	......
1886	0·60	0·09	0·09	0·05	0·13	0·46	0·32	0·00	......	......	0·00	0·95	......
1887	1·31	0·54	0·84	......	......	......	......	......	......	0·10	1·11	1·51	......
1888	2·03	0·28	0·93	......	......	......	......	......	......	0·33	0·28	0·70	......
1889	0·65	1·15	0·00	T	2·30	0·09	0 02	0·59	0·98	1·12	0·25	0·00	7 1
Means	0·95	0·42	0·31	0·07	0·79	0·70	0·35	0·28	0·29	0·31	0·35	0·88	5·7

During 1881-89 (1882, '85 and '89 complete), average monthly snowfall was: Jan., 9·0 in; Feb., 4·0; Mar., 3·
April, 0·3; Oct., 1·3; Nov., 3·0; Dec., 7·0. Mean annual snowfall, 27·6 in.; maximum recorded, 25·0 in., De
1883.

CLO-OOSE—Elevation, 30 ft.

52

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1912	......	......	......	......	......	3·44	1·70	5·48	5·51	9 61	17·03	8·04	......
1913	9·66	5·97	4·90	4·54	5·35	6·00	3·46	1·67	7·77	5·40	9·15	2·49	66·3
1914	2·91	1·28	1·50	1·58	0·90	1·07	0·22	0·21	1·69	6·88	18·56	5·87	42·6
1915	8·05	10·00	8·52	6·07	4·92	0·44	2·09	1·75	0·47	16·89	11·14	20·90	91·2

Snowfall in 1913, 10·5 in., all of which fell in Jan.; in 1914, 4·5 in., all in Jan.; in 1915, 7·8 in., all in De

COBBLE HILL (BOATSWAIN BANK)—Elevation, 33 ft.

53

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1913	......	......	......	......	......	......	......	......	......	3·80	7·51	2·01	......
1914	11·32	1·99	1·93	2·33	0·36	2·08	0·11	0·15	2·72	4·40	8·73	1·02	37·1
1915	3·69	2·10	2·03	2·05	1·84	0·63	0·60	0·06	0·79	4·64	6·16	8·84	33·4

Snowfall in Jan., 1914, 6·5 in.; Nov., 1·0; total in 1914, 7·5; in 1915, only a trace.

COLDSPRING RANCH—Elevation, 2,700 ft.

54

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1913	......	......	......	......	......	......	......	0·83	0·80	1·79	0·44	1·17	......
1914	3·00	0·60	0·29	0·32	1·67	0·77	0·23	0·41	1·81	0·47	1·18	0 95	11·7
1915	1·18	0·37	0·75	0·89	2·90	1·89	1·96	0·62	1·45	0·76	0·31	0·90	13·9

Snowfall in Dec., 1913, 5·0 in. In Jan., 1914, 12·2; Feb., 2·0; Mar., 2·9; April, 2·0; Nov., 5·5; Dec, 9·
total in 1914, 36·1. In Jan., 1915, 11·8; Feb., 3·7; Mar., 1·1; Nov., 1·3; Dec., 7·7; total in 1915, 25·6 i

COQUITLAM—Elevation, 34 ft.

55

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1902	4·82	11·84	8·87	6·41	5·64	2·15	2·28	1·74	3·77	5·06	12·88	12·07	77·5
1903	10·85	2·91	5·51	5·34	3·92	3·98	1·66	1·83	9·85	6·63	15·24	6·97	74·6
1904	13·40	10·40	8·22	4·00	2·21	2·93	2·24	1·14	2·91	4·50	12·31	......	......
1905	7·04	5·87	8·93	1·39	3·96	3·17	1·23	1·67	11·59	7·32	4·07	9·86	66·1
1906	11·89	7·64	2·81	1·37	5·07	4·49	0·58	0·63	12·51	9·66	9·83	9·66	76·1
1907	10·01	10·05	3·71	6·66	2·03	1·67	1·45	2·20	4·02	2·77	15·35	10·72	70·6
1908	7·20	7·83	9·47	4·72	3·76	1·33	2·01	1·55	2·49	7·58	13·97	10·48	72·3
1909	8·56	11·20	5·79	1·66	4·68	1·82	3·10	3·38	3·29	6·80	18·51	7·75	76·5

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

COQUITLAM—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	14·08	7·31	3·55	5·24	3·59	2·52	0·00	1·38	2·58	11·23	13·31	11·11	75·90
1911	7·48	4·17	5·14	1·78	5·65	1·76	0·43	1·57	7·00	1·88	12·34	9·70	58·90
1912	9·16	6·24	1·09	4·33	2·48	2·39	2·03	5·55	2·66	5·77	11·48	11·32	64·50
1913	10·64	6·72	8·09	3·61	4·73	5·62	1·66	3·92	4·10	7·05	11·51	5·12	72·77
1914	13·21	5·69	4·09	4·70	1·36	4·19	0·77	0·88	7·98	7·54	12·09	3·23	65·73
1915	6·82	5·24	5·40	4·78	4·00	0·88	1·74	0·50	1·15	12·10	7·24	13·32	63·27
Means	9·65	7·38	5·76	4·00	3·79	2·78	1·51	2·00	3·42	6·80	12·15	9·33	70·57

During 1902-15 (1904 incomplete), average monthly snowfall was: Jan., 10·3 in; Feb., 2·8; Mar, 1·2; April 0·3; Nov., 0·6; Dec., 1·8. Mean annual snowfall, 17·2 in.; maximum recorded, 47·8 in, Jan., 1913.

56

COQUITLAM LAKE DAM—Elevation, 430 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1903	18·48	5·21	8·67	9·34	7·78	7·30	3·55	2·68	17·47	17·88	13·10	14·73	146·21
1904	28·81	21·16	22·30	7·23	6·14	3·53	5·10	1·05	5·82	10·41	25·02	20·00	156·57
1905	13·25	16·91	23·36	4·50	4·61	3·16	3·99*	6·42	17·49	22·10*	10·62	18·07	144·48
1906	26·50	18·66	6·60	4·41	13·21	12·08	1·18	3·04	28·53	31·99	22·78	20·89	189·87
1907	12·38	16·93	10·35	15·74	5·20	3·92	2·45	5·15	8·98	4·28	37·09	24·78	147·25
1908	16·80	15·45	21·98	13·50	9·20	3·49	3·62	4·34	7·24	20·31	33·75	21·12	170·80
1909	15·50	23·03	10·46	3·07	12·62	3·90	4·69	8·60	7·51	21·21	37·29	12·02	159·90
1910	32·41	15·78	7·16	8·61	6·95	5·14	0·25	4·43	5·01	21·49	28·77	23·62	159·62
1911	21·59	10·12	9·66	5·63	9·62	4·34	1·45	2·21	9·54	5·45	29·48	22·96	132·05
1912	21·71	15·48	2·13	9·97	3·75	5·59	2·66	9·55	6·72	13·61	29·28	26·69	147·14
1913	15·88	10·14	13·04	7·56	9·58	7·57	3·62	3·15	8·14	14·43	26·09	11·64	130·84
1914	26·51	9·54	10·00	6·92	4·71	5·26	0·57	1·30	13·85	20·27	25·37	5·28	129·58
1915	15·87	10·95	12·24	8·62	7·38	0·63	2·29	0·86	1·56	24·59	15·02	24·91	124·92
Means	20·43	14·58	12·15	8·08	7·75	5·07	2·72	4·06	10·60	17·54	27·20	18·98	149·16

* Precipitation July-October, 1905, totalled 50 inches, which has been distributed over the 4 months—for the purpose of certain calculations.

57

CORONATION—Elevation, 3,750 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	.....	.....	.....	.....	1·10	1·23	1·91	1·06	0·52	4·32	5·48	5·51	.....

Snowfall in Nov., 1915, 54 0; Dec., 53 0 in.

58

CORTEZ (TWIN ISLAND)—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July–Annual
1915	3·60	4·18	2·71	2·52	2·23	0·37	Observer died, not yet replaced.

59

COWICHAN (TZOUHALEM)—Elevation, 170 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	.....	10·24	8·47	1·36	1·21	1·07	1·16	0·64	0·29	2·46	11·2[illegible]	12·97	.....
1905	8·08	5·04	5·88	0·42	2·79	1·66	0·70	1·17	4·94	4·53	3·08	6·54	44·83
1906	6·14	4·63	1·89	0·95	2·07	2·15	.....	.....	.....	.....	.....	.....	.....
1907	4·02	5·03	1·31	2·09	0·61	1·24	0·90	0·48	1·01	1·08	7·46	8·54	33·67
1908	9·16	6·28	3·68	1·74	2·47	0·21	0·13	0·93	0·30	3·76	10·01	6·49	45·16
1909	7·73	5·62	1·67	0·17	1·74	0·99	1·26	0·85	0·67	3·02	11·91	5·52	41·15
1910	6·04	3·33	2·16	0·94	1·14	1·29	T	0·93	1·25	2·86	10·29	8·07	38·30
1911	6·34	1·20	0·73	1·14	2·59	0·86	0·11	0·62	2·62	1·28	6·60	4·38	28·47
1912	6·51	4·53	0·83	2·03	2·05	1·67	0·67	2·54	1·56	3·39	6·81	7·29	39·88
1913	5·48	1·55	1·99	1·00	1·84	1·52	0·81	0·90	1·93	2·98	8·90	2·34	31·24
1914	13·04	2·35	2·08	2·78	0·31	2·29	0·15	0·26	3·40	5·15	9·40	1·53	42·74
1915	4·64	2·85	2·17	2·13	2·44	0·40	0·50	0·16	0·76	5·21	6·32	9·67	37·25
Means	7·02	4·39	2·74	1·41	1·77	1·28	0·58	0·86	1·70	3·24	8·35	6·61	39·93

During 1904-15 (1904 and 1906 incomplete), average monthly snowfall was: Jan., 10·7 in.; Feb., 5·2; Mar., 1·1; Nov., 2·8; Dec., 2·7. Mean annual snowfall, 22·5 in.; maximum recorded, 21·5 in., Jan., 1913.

60

COWICHAN BAY—Elevation, 50 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	.....	.....	.....	2·71	5·09	7·16	1·02	.....
1915	3·68	2·04	2·66	1·54	2·06	0·75	0·74	0·20	0·59	4·52	5·66	8·76	33·20

61

COWICHAN LAKE—Elevation, 540 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	1·15	6·31	6·72	21·06	8·17	.....
1914	25·95	7·60	7·68	7·12	1·50	2·88	0·12	0·28	5·72	15·33	16·29	2·53	93·00
1915	8·14	7·15	12·89	5·76	3·64	0·68	0·66	0·47	0·47	10·59	12·06	17·82	80·33

Snowfall in Jan., 1914, 20·5 in.; Feb., 2·5; Mar., 4·5; Nov., 3·0; Dec., 1·5; total in 1914, 32·0. In Jan., 1915, 0·1; Dec., 5·5; total in 1915, 5·6 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

CRANBERRY LAKE—Elevation, 2,460 ft.

62 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	4·52	0·83	4·55	7·80	......	......	......	......	......	......	......	......	......
1915	......	......	......	......	2·04	2·14	2·63	1·57	1·20	3·33	0·65	1·77	......

Snowfall in Jan., 1914, 3·2 in.; Feb., 1·3; Mar., 5·0; April, 3·5. In Nov., 1915, 4·5; Dec., 17·0 in.

CRANBROOK—Elevation, 3,014 ft.

63 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	......	......	......	......	......	......	......	0·00	1·24	0·43	1·18	0·30	......
1902	2·52	1·10	1·07	3·87	4·52	1·85	1·18	0·78	1·35	0·39	0·70	4·05	23·38
1903	6·60	......	2·41	0·90	0·82	2·13	3·65	......	......	......	......	......	......
1904	1·16	3·17	0·47	0·64	0·66	0·53	......	......	......	......	......	......	......
1905	1·60	1·85	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1908	......	......	......	......	......	2·19	0·31	0·19	0·74	0·92	0·70	0·51	......
1909	2·36	0·90	0·45	0·89	0·89	1·73	1·46	0·16	0·98	0·69	2·86	1·16	14·53
1910	0·78	1·59	0·67	0·30	0·64	1·16	......	0·49	1·87	1·54	3·43	2·10	......
1911	3·72	0·46	1·63	0·35	1·26	2·35	0·40	......	2·10	0·17	1·40	1·36	......
1912	1·10	0·20	0·03	0·35	1·08	1·65	3·76	1·01	0·36	1·14	1·16	0·11	12·18
1913	2·60	0·04	2·20	0·48	2·95	0·86	1·26	2·24	0·81	0·44	1·67	0·80	16·35
1914	3·83	0·15	0·70	0·79	1·08	2·02	[illegible]	0·44	1·27	1·57	2·47	0·80	16·09
1915	0·60	0·70	0·12	0·12	2·26	2·13	2·88	0·31	1·84	0·94	2·84	1·50	16·24
Means	2·44	1·02	0·97	0·88	1·62	1·60	1·76	[illegible]	1·28	0·82	1·85	1·29	16·24

During 1901-15 (1902 and 1909-15 complete), average monthly snowfall was: Jan., 20·7 in.; Feb., 9·0; Mar. 5·3; April, 1·1; Nov., 8·9; Dec., 11·4. Mean annual snowfall, 56·4 in.; maximum recorded, 66·0, Jan., 1903.

CRANBROOK CITY—Elevation, 3,020 ft.

64 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	0·39	2·41	0·61	......
1914	2·37	0·77	0·80	0·74	1·02	1·71	0·99	0·38	0·88	1·63	2·31	1·27	14·87
1915	1·46	0·84	0·11	0·95	1·92	0·97	2·78	0·40	1·76	0·50	2·21	2·27	16·26

Snowfall in Nov., 1913, 9·9 in.; Dec., 6·1. In Jan., 1914, 23·7; Feb., 4·6; Mar., 6·2; Nov., 10·0; Dec. 11·0; total in 1914, 55·5. In Jan., 1915, 14·6; Feb., 1·6; Nov, 10·5; Dec., 12·0; total in 1915, 38·7 in.

CRAWFORD BAY—Elevation, 2,000 ft.

65 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	......	......	......	......	......	......	......	7·52	3·46	1·90	4·25	5·93	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1911	......	......	......	......	......	......	......	......	2·62	0·45	8·28	1·60	......
1912	3·47	2·04	0·86	0·84	1·79	2·04	3·30	2·44	1·21	1·71	3·41	3·77	26·88
1913	4·60	2·41	3·76	1·32	0·80	0·78	0·60	2·19	2·56	1·93	2·39	1·05	24·39
1914	7·45	1·42	1·97	2·04	1·33	1·58	1·00	0·83	2·75	1·68	2·46	1·87	26·38
1915	1·80	2·33	1·18	3·31	3·41	1·99	3·34	0·76	1·86	4·48	4·96	6·41	35·83

During 1907-15 (1912-15 complete), average monthly snowfall was: Jan., 36·5 in.; Feb., 7·[illegible] Mar., 7·3 April, 1·2: Nov., 16·3; Dec., 26·3. Mean annual snowfall, 95·3 in.; maximum recorded, 55·4 i[illegible] [illegible]n., 1914.

CRESTON—Elevation, 1,985 ft.

66 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	0·94	2·46	1·20	0·99	1·90	3·7	1·74	......
1913	2·38	0·43	1·48	0·33	1·49	2·01	1·82	1·14	1·32	0·66	5·10	0·80	18·96
1914	5·38	1·57	1·71	1·17	2·28	1·25	0·69	0·22	1·82	1·97	2·25	0·79	21·10
1915	1·40	1·32	0·74	1·07	2·06	1·37	3·27	0·29	2·08	1·19	3·27	3·71	21·77

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 24·7 in.; Feb., 6·3; Mar., 4·1; April 1·0; Oct., 0·2; Nov., 15·1; Dec., 15·1. Mean annual snowfall, 66·5 in.; maximum recorded, 36·3 in., Jan., 1914

CRESTON (WEST KOOTENAY RECLAMATION FARM)

67 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	......	......	1·36	1·49	0·53	1·35	0·19	1·04	0·67	1·21	7·36	3·99	......
1897	2·26	1·69	2·06	0·39	0·67	3·88	2·22	0·42	1·61	1·51	5·04	3·50	24·25
1898	1·55	4·71	1·65	0·84	1·74	1·09	1·68	1·11	1·21	1·04	1·98	1·15	19·75
1899	2·16	1·32	1·34	1·73	1·86	1·76	0·51	2·98	1·03	2·02	3·87	1·68	22·26
1900	2·12	1·46	2·24	0·68	1·52	2·65	0·74	1·81	1·94	3·55	2·63	3·51	24·85
1901	3·28	1·35	1·[illegible]	2·04	3·20	3·10	1·43	0·17	1·78	0·92	2·73	1·72	22·86
1902	1·91	2·71	1·[illegible]	1·44	3·79	1·71	2·23	1·12	1·18	0·40	4·06	5·71	27·92
1903	3·38	0·55	4·[illegible]	0·84	0·98	1·54	1·67	1·19	1·87	1·23	2·65	1·90	21·96
1904	3·26	5·22	4·14	1·31	0·86	1·34	1·87	0·32	......	......	......	......	......
Means	2·48	2·38	2·19	1·20	1·68	1·94	1·39	1·12	1·41	1·48	3·52	2·63	23·42

During 1896-1904 (1896 and 1904 incomplete), average monthly snowfall was: Jan., 17·5 in.; Feb., 14·9 Mar., 11·9; April, 2·1; Nov., 15·0; Dec., 17·7. Mean annual snowfall, 79·1 in.; maximum recorded, 49·9 in. Dec., 1902.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

68

CROWSNEST—Elevation, 4,450 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	......	0·37	0·23	2·59	3·75	0·05	0·65	......
1915	0·40	0·40	0·10	2·64	0·90	1·49	2·28	0·13	1·43	0·35	0·20	1·40	11·72

Snowfall in Sept., 1914, 2·0 in.; Oct., 17·0; Nov., 0·5; Dec., 6·5. In Jan., 1915, 4·0; Feb., 4·0; Mar., 1·0
Oct., 2·0; Nov., 2·0; Dec., 14·0; total in 1915, 27·0 in.

69

CUMBERLAND*

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1898	......	......	0·51	3·79	2·19	3·23	0·59	0·04	3·39	3·39	6·56		
1899	2·80	4·43	2·30	2·75	2·23	1·00	1·81	3·04	1·81	6·84	24·30	3·44	56·75
1900	6·78	3·23	9·91	......	......	......	......	3·35	1·74	9·89	7·41	17·93	......

Snowfall in Nov., 1898, 6·5 in. In Jan., 1899, 28·0; Feb., 13·8; Mar., 4·0; Dec., 3·0; total in 1899, 48·8.
In Jan., 1900, 3·5; Feb., 10·0; Mar., 1·5; Nov., 7·5 in.

70

DEER PARK—Elevation, 1,450 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	0·20	1·87	4·87	0·50	4·40	0·00	0·14	1·59	0·80	2·32	1·25	......
1915	0·70	0·28	0·74	2·44	2·46	1·17	1·31	0·01	0·94	0·80	2·16	2·72	15·73

Snowfall in Feb., 1914, 2·0 in.; Mar., 1·2; Dec., 8·5. In Jan., 1915, 7·0; Feb., 0·5; Nov., 8·0; Dec., 27·2;
total in 1915, 42·7 in.

71

DENMAN ISLAND—Elevation, 40 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1906	......	......	......	......	......	......	0·00	0·14	6·09	8·60	11·57	9·45	......
1907	3·80	6·11	2·90	5·30	4·77	1·37	1·23	1·11	2·32	1·95	9·55	11·47	51·88
1908	12·85	7·11	3·40	3·41	1·90	1·65	3·64	0·62	1·06	4·21	19·82	7·04	66·71
1909	5·13	9·71	1·68	0·00	1·08	......	......	......	......	1·36	1·50	1·75	......
1910	......	......	......	1·97	1·32	2·19	0·03	1·20	1·82	6·85	12·74	7·18	......
1911	5·31	2·67	0·69	1·61	4·76	0·41	0·17	0·71	2·62	3·44	5·00	4·97	32·36
1912	7·48	7·58	1·10	1·11	1·81	1·09	1·39	3·68	1·53	4·23	10·72	9·06	50·78
1913	5·34	2·49	1·64	2·12	0·90	2·10	1·58	0·98	3·93	4·52	13·58	5·39	44·57
1914	15·88	4·84	3·61	4·66	0·40	2·36	0·36	0·45	5·28	11·15	11·59	4·85	65·43
1915	6·29	5·81	3·94	2·46	1·45	0·16	0·16	0·05	1·68	9·87	8·11	12·73	53·16
Means	7·76	5·79	2·37	2·52	2·04	1·47	0·95	0·99	2·92	6·24	10·42	7·39	50·86

During 1907-15 (1909 and 1910 incomplete), average monthly snowfall was: Jan., 7·7 in.; Feb., 2·0; Mar.,
0·1; Nov., 3·0; Dec., 1·1. Mean annual snowfall, 13·9 in.; maximum recorded, 24·0 in., Jan., 1913.

72

DEPARTURE BAY—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	4·82	1·64	2·25	1·43	1·96	2·77	1·87	0·45	2·30	4·13	7·32	2·15	32·99
1914	10·37	2·69	2·43	2·53	0·73	1·87	0·07	0·46	3·78	6·20	7·40	1·71	40·24
1915	3·88	3·27	3·24	1·81	2·57	1·28	0·80	0·21	0·28	5·50	5·36	8·28	36·48

Snowfall in Jan., 1913, 25·5 in.; Mar., 16·5; total in 1913, 42·0. In Jan., 1914, 12·7; Feb., 0·3; Mar., 5·3;
Nov., 0·8; Dec., 1·0; total in 1914, 20·1.; total in 1915, 2·6 in., all in Dec.

73

DONALD—Elevation, 2,090 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	......	......	1·60	1·24	1·20	1·85	1·16	0·39	4·60	2·46	2·13	6·26	......
1896	8·38	3·68	1·65	1·33	1·03	0·58	0·10	0·80	0·57	......	......	......	......
1897	......	......	......	......	......	......	0·00	1·44	6·57	0·49	5·67	4·60	......
1898	1·67	5·25	0·42	0·07	0·59	1·88	1·15	1·08	1·20	1·53	2·53	1·95	19·32
1899	2·38	1·48	1·37	1·15	2·26	1·25	1·66	4·38	1·06	0·99	2·65	......	......
Means	4·14	3·47	1·26	0·95	1·27	1·39	0·81	1·62	2·80	0·87	3·24	4·30	26·12

During 1892-99 (partial record for four years) average monthly snowfall was: Jan., 31·9 in.; Feb., 18·9; Mar.,
6·4; April, 3·3; May, 1·2; Oct., 2·2; Nov., 25·4; Dec., 36·1. Mean annual snowfall, 125·4 in.; maximum
recorded, 77·0 in., Jan., 1896.

74

DOUGLAS LAKE—Elevation, 2,600 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	......	0·40	0·69	0·17	0·91	1·29	......	......	......	......	0·80	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1882	......	......	......	......	0·80	1·87	0·85	1·12	0·76	1·01	0·69	1·18	......
1883	1·30	1·10		0·13	0·59	0·61	0·32	0·27	0·92	1·15	1·21	0·45	......
1884	1·43	0·90	0·51	0·55	0·17	1·29	1·86	1·15	1·16	0·59	0·13	0·68	10·42
1885	......	......	......	......	......	......	......	......	......	......	......	......	......
1886	1·85	0·63	0·40	0·26	0·44	0·76	0·59	0·39	0·48	0·84	......	......	......

During 1882-86 (partial record for three years), average monthly snowfall was: Jan., 15·3 in.; Feb., 6·8; Mar.
2·3; May, 0·8; Oct., 0·8; Nov., 5·3; Dec., 5·3; total, 1884, 31·1 in.; maximum recorded, 18·5 in., Jan., 1886.

* Observer moved to Cumberland from Union Bay, which see for supplementary record.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

DUCK LAKE RANCH—Elevation, 1,400 ft.

75 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1913	......	......	......	[illegible]	1·70	2·62	0·59	1·02	0·90	1·81	0·93	0·25	......
1914	2·88	1·52	2·14	......	......	0·87	0·21	0·35	2·92	1·46	1·20	......	......

Snowfall in Nov., 1913, 3·0 in.; Dec., [illegible]. In Jan., 1914, 17·4; Feb., 3·5; Mar., 1·0 in.

DUNCANS—Elevation, 40 ft.

76 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1895	9·81	3·21	3·83	[illegible]	[illegible]	0·29	0·60	0·26	1·10	0·20	3·60	10·75	39·89
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1901	......	4·61	[illegible]	[illegible]	[illegible]	1·91	0·34	0·31	1·40	2·30	11·05	5·81	......
1902	6·16	11·14	[illegible]	[illegible]	1·70	0·92	......	......	1·11	2·55	8·66	11·59	......
1903	5·94	3·65	[illegible]	[illegible]	[illegible]	1·90	......	......	......	......	......	......	......

Snowfall in Jan., 1895, 32·8 in [illegible]; Dec., 17·1; total in 1895, 52·5. In Feb., 1901, 2·5. In Jan., 1902, 10·0; Mar., 0·6 in.

[illegible] PARK—Elevation, 1,413 ft

77 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1914	......	......	1·99	[illegible]	[illegible]	2·44	1·41	0·68	3·52	2·71	3·76	1·80	......
1915	1·70	1·30	0·69	[illegible]	[illegible]	3·56	[illegible]	1·19	1·81	2·61	3·00	3·72	31·20

Snowfall in Mar., 1914, 11·4 in., No[illegible] In [illegible] 1915, 17·0; Feb., 10·0; April, 2·3; Nov 18·5; Dec, 34·8; total in 1915, 82·8 in.

[illegible] LAKE—[illegible], 3,714 ft.

78 [illegible]

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1914	......	......	......	[illegible]	......	[illegible]	......	0·66	3·05	3·27	3·49	1·02	......
1915	2·38	1·17	1·34	[illegible]·14	[illegible]	[illegible]	1·63	2·02	1·81	4·59	1·92	2·27	23·78

Snowfall in Nov., 1914, 11·0; Dec., [illegible]0·2. In [illegible], 18·2; Feb., 11·7; Nov., 18·0; Dec., 20·0; total in 1915, 67·9 in.

EDGEWATER (BRISCO)—Elevation, 2,620 ft

79 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	2·65	0·60	4·00	0·52	......
1914	2·16	0·30	0·30	0·93	1·25	1·63	1·15	0·46	3·40	......	......	......	......
1915	......	......	......	1·03	0·90	3·75	3·37	0·37	0·79	0·80	0·45	0·89	......

Snowfall in Nov., 1913, 7·5 in.; Dec., 5·2. In Jan., 1914, 11·0; Feb., 3·0; Mar., 3·0. In Sept., 1915, 2·0; Nov., 4·5; Dec., 8·0 in.

EDITH LAKE—Elevation, 3,200 ft

80 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1914	......	......	......	......	......	......	......	......	......	......	......	0·54	......
1915	1·85	0·45	0·61	0·30	2·25	4·08	1·77	0·73	0·72	0·80	1·48	2·60	17·73

Snowfall in Dec., 1914, 5·4 in. In Jan., 1915, 18·5; Feb., 4·5; Mar., 2·3; Nov., 14·8; Dec., 22·0; total in 1915, 62·1 in.

ELKO CITY—Elevation, 3,100 ft.

81 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	0·63	0·82	2·84	0·50	......
1914	3·06	0·70	0·92	2·48	1·74	2·22	1·29	1·79	2·28	2·17	2·20	0·95	21·80
1915	1·55	0·87	1·04	1·35	1·94	4·10	3·17	0·27	3·55	1·82	2·77	3·53	23·98

Snowfall in Nov., 1913, 11·0 in.; Dec., 3·0. In Jan., 1914, 21·0; Feb., 5·7; Nov., 4·7; Dec., 9·5; total in 1914, 38·9. In Jan., 1915, 15·3; Feb., 6·2; Nov., 21·7; Dec., 27·5; total in 1915, 72·9 in.

ENDERBY—Elevation, 1,180 ft.

82 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct	Nov.	Dec.	Annual
1894	3·90	1·10	1·50	1·86	0·60	1·65	0·80	0·00	2·63	2·14	2·06	1·10	19·34
1895	1·95	2·02	1·04	1·73	3·29	1·23	0·16	0·11	3·48	1·05	2·05	2·52	20·63
1896	2·90	1·64	0·10	1·60	1·56	1·21	0·00	0·62	0·87	1·19	2·53	4·27	18·49
1897	2·13	1·75	1·57	0·49	0·58	2·55	1·46	1·85	0·78	0·79	4·12	2·55	21·89
1898	3·07	2·71	1·31	0·42	1·61	3·95	2·51	0·60	1·25	1·98	2·70	1·82	23·93
1899	6·02	3·48	0·97	1·06	1·44	2·06	1·52	3·03	1·78	1·86	3·56	1·24	28·02
1900	1·53	1·69	0·50	0·51	1·68	2·51	2·21	2·90	2·06	2·19	1·55	1·67	22·55
1901	0·92	0·97	0·58	0·62	0·81	2·50	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1904	2·67	1·56	1·58	0·57	0·52	1·22	1·18	0·09	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1909	......	......	......	......	......	......	2·58	0·78	2·48	1·26	0·83	0·00	......
1910	1·25	1·55	1·77	0·69	0·71	2·78	1·38	1·07	0·94	3·05	3·53	1·53	21·23
1911	2·43	1·45	0·91	0·42	1·51	1·42	2·06	1·75	1·74	0·20	6·08	3·29	23·26
1912	3·19	1·24	......	......	......	0·87	2·18	1·28	1·04	1·39	1·96	2·45	......
1913	4·13	1·38	0·64	0·05	1·40	3·73	1·18	1·97	1·35	1·11	1·71	1·10	19·75
1914	2·52	1·60	0·82	1·02	1·12	1·68	0·88	0·27	2·49	1·23	1·89	1·10	16·62
1915	2·29	0·54	1·39	2·15	2·88	4·84	2·28	0·20	1·23	1·19	0·96	2·10	22·05
Means	2·73	1·65	1·05	0·94	1·41	2·28	1·49	1·10	1·72	1·47	2·54	1·91	20·29

During 1894-1915 (complete record for 12 years), average monthly snowfall was: Jan., 19·9 in.; Feb., 11·9; Mar., 4·0; April, 0·6; Nov., 11·3; Dec., 15·8. Mean annual snowfall, 63·5 in.; maximum recorded, 41·3 in. Jan., 1913.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

ENTRANCE ISLAND—Elevation, 45 ft.

85

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1915	3·80	2·66	2·39	1·27	1·54	0·54	0·24	0·31	0·02	3·86	4·83	7·44	28·90

In 1915, the total snowfall was 0·3 inch, all of which fell in December.

ESTEVAN POINT—Elevation, near sea-level

86

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1909	9·15	9·42	10·07	3·43	4·18	3·79	2·54	9·97	4·66	13·36	14·60	5·63	90·84

Snowfall in Jan., 1909, 8·3 in.; Feb., 0·0; Mar., 0·5; Dec., 0·3; total in 1909, 9·1 in.

FAIRVIEW

86

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1906	......	......	......	......	3·63	1·12	0·05	0·44	0·21	0·22	3·58	2·30	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1909	......	......	......	......	......	0·09	0·00	0·20	1·45	0·20	0·12	1·00	......
1910	0·59	0·90	0·10	0·13	0·19	0·35	0·36	0·23	0·13	0·19	0·50	1·00	4·67
1911	1·80	0·60	0·28	0·18	0·54	0·36	0·11	0·13	0·37	0·17	0·73	1·03	6·32
1912	0·72	0·08	Station closed										

During 1906-12 (complete record for 2 years), average monthly snowfall was: Jan., 9·5 in.; Feb., 5·0; Nov., 2·8; Dec., 13·4. Total snowfall in 1910, 24·0; in 1911, 41·5; maximum recorded, 23·0 in., Dec., 1906.

FERGUSON

86

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1908	......	......	......	......	......	3·45	1·76	2·00	2·89	3·77	6·80	8·45	......
1909	9·93	8·67	2·01	1·76	1·73	2·47	3·19	1·35	3·33	4·75	7·61	4·65	51·45
1910	5·95	7·30	4·05	5·18	1·57	2·32	0·87	1·30	2·10	6·16	7·27	6·55	50·62
1911	9·25	2·20	3·50	2·27	2·09	3·48	2·28	2·02	2·97	0·62	9·00	4·55	44·23
1912	5·88	3·30	1·15	2·29	1·71	1·87	3·38	4·65	1·33	4·28	8·06	11·30	49·20
1913	6·70	3·20	4·65	2·28	2·97	3·00	3·25	1·97	4·92	4·30	7·98	2·70	47·92
1914	10·03	3·00	4·18	3·68	2·09	4·23	1·59	0·94	5·31	3·50	8·16	2·80	49·51
1915	5·40	3·95	1·25	3·85	3·15	4·40	3·30	1·30	2·30	5·85	5·50	8·80	49·05
Means	7·59	4·52	2·97	3·04	2·19	3·15	2·45	1·94	3·14	4·15	7·55	6·23	48·92

During 1908-15 (1908 incomplete), average monthly snowfall was: Jan., 72·3 in.; Feb., 44·5; Mar., 23·3. April, 4·2; May, 0·4; Oct., 4·9; Nov., 56·9; Dec., 61·8. Mean annual snowfall, 268·3 in.; maximum recorded. 113·0 in., Dec., 1912.

FERNIE (DOMINION STATION)—Elevation, 3,305 ft.

87

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	......	1·48	......
1914	10·94	1·23	1·18	2·48	1·64	1·38	1·45	2·15	4·77	4·47	7·09	1·81	40·59
1915	1·84	2·83	0·75	1·05	2·83	4·47	1·84	0·26	2·19	3·45	6·84	5·91	34·26

Snowfall in Jan., 1914, 68·5 in., Feb., 7·5; Nov., 12·5; Dec., 18·1. In Jan., 1915, 18·4; Feb., 21·3; Mar., 1·2; Sept., 1·0; Oct., 0·0; Nov., 51·8; Dec., 43·0; total in 1915, 136·7 in

FERNIE (PROVINCIAL STATION)—Elevation, 3,305 ft.

88

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	1·34	1·22	1·39	2·19	4·93	5·81	5·80	1·57	......
1915	1·77	3·00	0·89	1·48	2·13	4·30	2·50	0·23	2·15	3·91	7·39	8·64	38·39

Snowfall in Nov., 1914, 8·7 in.; Dec., 15·7. In Jan., 1915, 17·7; Feb., 24·0; Mar., 1·7. Nov., 6[illegible]5; Dec., 71·0; total in 1915, 179·9 in.

FIFTEEN-MILE RANCH (PAVILION P.O.)

89

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	0·40	......	......
1914	1·40	0·46	0·39	0·24	0·89	1·18	0·44	0·10	1·92	0·37	2·50	0·45	10·34
1915	0·58	0·38	0·15	0·52	1·64	1·01	1·48	1·93	0·15	0·42	......	......	......

Snowfall in Dec., 1913, 1·0 in. In Jan., 1914, 7·3; Feb., 4·5; Nov. 3·5; Dec., 4·5; total in 1914, 19·8 in. In Jan., 1915, 5·8; Feb., 3·8 in.

FIFTH CABIN

90

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	0·48	4·80	1·87	2·72	3·75	5·77	2·14	......
1915	4·18	2·74	1·89	2·42	1·42	3·07	5·98	2·67	1·19	4·52	4·23	5·97	40·26

Snowfall in Nov., 1914, 50·5 in.; Dec., 21·4. In Jan., 1915, 40·3; Feb., 27·4; Mar., 8·2; April, 5·2; Oct., 10·0; Nov., 42·3; Dec., 59·7; total in 1915, 193·1 in.

FORT GEORGE—Elevation, 1,863 ft.

91

See under Prince George, which follows record No. 206.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

FORT ST. JAMES (STUART LAKE)—Elevation, 2,280 ft.

92 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1894	3·42	1·33	0·99	2·26	0·48	1·67	0·78	0·63	1·93	1·37	3·22	1·29	19·37
1895	1·16	1·76	1·14	0·65	1·62	0·91	2·26	2·51	2·07	1·69	3·28	1·47	21·61
1896	4·24	3·45	1·63	0·83	0·23	1·51	1·27	0·40	0·36	1·78	1·13	3·07	19·90
1897	2·39	1·44	1·40	1·41	1·88	1·91	2·06	1·03	1·39	1·48	1·94	0·72	19·25
1898	0·00	0·00	0·45	0·07	0·30	0·94	3·04	0·38	0·65	1·33	0·85	0·71	8·74
1899	3·93	0·18	1·00	0·03	0·80	T	T	T	0·95	1·60	0·35	1·72	10·56
1900	0·95	2·48	1·06	0·30	1·41	1·37	1·55	0·68	0·50	0·32	1·20	1·40	13·22
1901	1·20	0·25	0·70	1·20	1·35	1·63	1·45	0·15	0·40	0·30	2·60	1·43	12·68
1902	1·15	1·45	0·43	0·50	1·30	1·90	1·61	2·03	1·16	0·57	1·82	2·07	15·99
1903	0·67	0·37	0·55	1·72	0·52	3·40	1·30	3·09	1·47	1·76	2·16	1·28	18·29
1904	1·28	1·22	0·80	0·18	1·14	1·64	0·87	0·20	2·10	1·19	1·98	2·41	15·01
1905	0·89	0·89	1·23	1·01	1·24	0·57	0·33	2·96	0·96	1·30	1·02	2·41	14·81
1906	1·75	0·59	0·02	0·81	0·33	1·74	0·98	0·87	1·55	2·21	2·32	1·75	14·80
1907	1·43	0·66	0·48	1·02	0·74	1·69	0·94	2·80	1·69	0·63	1·39	1·26	14·73
1908	0·70	2·33	1·90	1·31	3·28	2·01	1·61	1·41	2·13	0·60	2·31	1·15	20·75
1909	1·05	1·61	1·17	0·60	0·22	1·25	0·49	1·86	1·31	1·26	1·57	1·07	12·38
1910	0·74	1·30	0·63	0·56	2·33	1·55	1·30	1·73	1·13	1·93	3·30	1·95	18·45
1911	1·30	0·68	0·73	1·68	0·25	1·62	1·03	0·76	0·97	0·65	2·00	1·89	13·56
1912	1·32	0·70	0·14	1·04	0·35	1·12	0·25	2·26	0·68	0·75	0·80	3·81	13·22
1913	2·59	0·72	1·01	0·83	1·47	1·27	3·25	1·87	2·51	1·79	1·27	0·80	19·38
1914	1·31	1·41	1·15	0·74	0·43	1·10	2·75	0·32	1·00	0·89	0·81	0·78	12·69
1915	0·36	0·84	0·73	0·73	1·36	1·54	3·54	0·60	0·89	2·25	0·90	0·86	14·60
Means	1·55	1·17	0·88	0·89	1·05	1·47	1·48	1·30	1·26	1·26	1·74	1·60	15·65

During 1894-1915, average monthly snowfall was: Jan., 13·3 in.; Feb., 9·6; Mar., 5·7; April, 2·6; May, 0·1; Sept., 0·3; Oct., 1·4; Nov., 11 9; Dec., 12 3. Mean annual snowfall, 57 2 in.; maximum, 37 1 in., Jan., 1896

FORT ST. JOHN—Elevation, 1,500 ft.

93 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	0·25	0·41	0·93	0·40	0·93	1·89	......	......	......	......	1·45	0·43	......
1911	0·75	0·55	0·65	0·90	2·03	1·01	1·53	......	......	......	......	......	......

Snowfall in Jan., 1910, 2·5 in.; Feb., 4·1; Mar., 9·0; April, 0·5; Nov., 14·5; Dec., 4·3; total in 1910, 34·9. In Jan., 1911, 7·5; Feb., 5·5; Mar., 6·5; April, 9·0 in.

FORT STEELE—Elevation, 2,433 ft.

94 See under Steele, which follows record No. 242.

FRENCH CREEK*—Elevation, 125 ft.

95 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1892	2·36	0·57	2·98	3·36	2·75	1·24	1·82	0·63	5·26	2·70	8·46	3·95	36·08
1893	3·50	4·17	3·86	2·06	3·12	1·79	1·61	0·41	3·12	3·20	4·91	3·89	35·64
1894	6·98	3·41	3·73	2·69	2·10	2·11	0·25	0·51	3·03	4·00	4·32	4·56	37·69
1895	6·98	2·61	4·01	1·57	2·42	0·64	0·26	0·32	1·89	0·28	3·45	8·87	33·34
1896	10·83	4·97	2·01	1·58	2·61	1·03	0·08	0·31	0·51	2·12	5·22	6·61	37·88
1897	2·52	1·75	3·43	1·08	0·95	1·95	1·71	0·88	0·97	2·38	7·08	9·09	33·79
1898	2·01	5·36	1·03	1·47	1·96	1·42	0·48	0·07	2·28	2·30	5·19	5·11	28·68
1899	5·42	2·73	2·17	0·94	1·37	1·39	0·87	2·85	1·23	4·22	11·19	6·23	40·61
1900	5·90	3·27	5·03	1·43	3·37	2·88	0·94	1·56	1·14	4·94	3·82	8·34	42·62
1901	7·01	2·85	1·62	3·32	2·26	1·94	0·62	0·36	1·12	1·80	6·58	5·69	23·17
1902	3·47	6·02	5·86	1·02	1·89	1·50	1·10	1·18	2·01	3·40	5·30	7·79	40·54
1903	2·24	0·72	2·24	......	......	......	......	......	......	......	......	......	......
Means	4·94	3·20	3·16	1·87	2·25	1·63	0·89	0·83	2·05	2·85	5·95	6·38	36·00

During 1892-1902, average monthly snowfall was: Jan., 11·7 in.; Feb., 6·0; Mar., 2·1; Nov., 5·0; Dec., 4·5. Mean annual snowfall, 29·3 in.; maximum, 37·0 in., Jan., 1901.

FRUITLANDS (TOBACCO PLAINS, NEAR FLAGSTONE)—Elevation, 2,634 ft.

96 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	......	0·15	0·20	0·27	0·67	1·00	1·09	0·76	0·29	1·06	4·49	0·42	......
1897	0·49	1·35	1·60	0·94	0·77	3·71	2·28	0·00	2·14	0·85	3·41	0·85	18·39
1898	0·40	1·30	1·11	1·20	1·75	2·06	1·59	1·87	......	0·96	0·95	0·54	......
1898	1·27	1·12	0·50	0·95	1·41	3·33	2·90	4·10	1·51	0·89	1·40	2·03	21·41
1900	1·17	0·48	1·49	1·25	2·57	2·05	1·34	2·20	1·23	1·91	1·71	0·68	18·08
1901	2·85	1·57	0·30	0·77	2·13	4·10	0·92	0·14	1·85	0·63	1·34	0·65	17·23
1902	1·28	1·24	0·40	0·58	5·63	1·52	1·84	1·16	1·43	0·43	1·80	1·85	19·18
1903	0·98	0·37	1·74	0·09	0·79	1·93	2·13	0·90	1·34	0·66	1·50	0·30	12·73
1904	1·01	2·07	2·79	1·29	0·72	0·82	0·99	0·91	0·09	0·26	1·25	1·05	13·25
1905	1·80	0·65	0·48	0·25	......	2·45	2·28	0·22	1·10	2·39	1·11	1·35	......
1906	1·99	1·29	0·62	0·89	3·75	2·72	0·83	1·47	0·35	1·50	3·25	1·66	20·32
1907	2·40	1·65	1·71	1·39	1·35	3·43	3·21	3·93	2·98	T	0·89	1·70	24·64
1908	0·70	2·30	2·29	1·23	5·28	2·56	0·43	0·66	......	......	1·33	0·71	......
1909	2·75	1·02	0·27	1·48	1·85	1·30	3·19	T	1·24	1·35	3·65	1·91	20·01

* See also record for Little Qualicum.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

FRUITLANDS—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	1·26	2·55	0·54	1·07	1·87	0·84	0·52	0·08	1·36	1·58	4·19	2·16	18·02
1911	1·67	1·30	1·61	0·47	3·93	2·97	0·87	1·54	1·62	0·36	2·60	1·84	20·78
1912	2·23	1·17	0·99	1·24	1·20	2·64	3·85	2·56	2·14	2·56	2·57	0·94	24·09
1913	2·72	0·21	0·62	0·72	2·38	4·05	2·11	1·93	0·78	0·45	0·35	0·60	17·92
1914	1·91	0·50	1·06	1·48	2·01	2·74	0·90	1·62	1·39	2·45	2·09	0·80	18·94
1915	1·85	1·14	0·86	0·72	2·91	3·99	2·27	0·60	4·38	1·93	2·11	2·10	24·86
Means	1·62	1·17	1·06	0·91	2·26	2·51	1·77	1·33	1·51	1·12	2·10	1·21	18·57

During 1896-1915 (4 years incomplete), average monthly snowfall was: Jan., 12·0 in.; Feb, 8·4; Mar., 5·6; April, 0·6; Oct., 0·6; Nov., 8·2; Dec., 9·5; Mean annual snowfall, 44·9; maximum recorded, 25·0 in., Jan., 1913.

97 FRUITVALE—Elevation, 1,984 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	.....	1·70	1·94	1·09	1·67	2·17	0·69	0·69	1·19	2·92	4·18	4·50	.....
1911	2·27	0·73	1·10	0·81	3·65	2·03	0·80	1·02	.....	.....	.....	.....	.....

Snowfall in Feb, 1910, 15·6 in.; Mar., 3·2; Nov., 4·2; Dec., 21·6. In Jan., 1911, 22·7 Feb., 7·3; Mar., 4·5; April, 4·9 in.

98 GILLIES BAY (VANANDA)—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	2·25	1·58	3·73	1·98	1·64	3·84	5·38	8·26	2·35	.....
1914	10·27	3·99	2·58	3·83	0·96	2·33	0·26	0·51	5·09	8·18	8·88	1·96	48·84
1915	4·15	2·81	2·94	1·81	1·88	0·53	1·66	0·19	0·76	7·01	4·32	8·91	36·97

Snowfall in Jan., 1914, 2·0 in.; Feb., 1·3; Mar., 2·0; Nov., 3·0; Dec., 1·0; total in 1914, 9·3; in 1915, 4·0 in., all in Dec.

99 GLACIER—Elevation, 4,072 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1894	7·60	6·50	4·85	5·50	2·74	3·26	1·14	0·81	7·18	4·40	10·95	3·65	58·57
1895	6·10	.....	3·98	4·25	2·25	4·75	2·70	0·95	4·31	2·29	7·45	9·05	.....
1896	13·32	9·80	4·15	2·65	0·52	0·88	0·16	0·72	2·15	0·48	11·02	10·20	56·05
1897	5·22	6·87	7·09	1·18									
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1902	3·60	5·20	5·65	1·75	0·00	4·60	3·24	.....	4·87	2·97	9·10	7·60	.....
1903	6·85	3·40	6·20	3·00	1·15	2·20	.....	.....	.....	.....	.....	4·50	.....
1904	11·25	0·15	6·98	0·60	1·70	.....	.....	.....	.....	.....	4·80	6·60	.....
1905	3·25	2·40	2·23	.....	.....	.....	.....	.....	.....	1·65	3·30	7·85	.....
1906	9·03	4·35	.....	1·10	.....	.....	.....	.....	.....	.....	.....	.....	.....
1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1908	9·85	6·40	10·55	1·60	.....	.....	3·32	2·40	5·01	4·80	10·69	10·40	.....
1909	12·00	7·80	1·60	3·65	1·38	3·05	2·32	1·97	5·85	5·12	11·90	5·50	62·14
1910	8·85	6·30	8·65	5·50	1·69	3·65	1·03	2·83	4·08	9·21	7·77	9·85	69·41
1911	12·95	4·50	7·80	4·15	3·53	2·04	2·87	2·55	2·38	0·62	12·05	8·55	63·99
1912	7·90	7·80	1·20	1·75	1·67	2·48	4·32	8·64	2·30	5·31	10·95	13·65	67·97
1913	10·10	5·25	8·05	2·20	1·36	2·52	4·06	6·77	8·32	5·35	10·10	3·55	67·63
1914	10·45	4·95	9·00	4·25	2·93	3·37	1·88	0·88	3·33	2·55	9·10	3·55	56·24
1915	5·60	4·30	0·63	2·76	2·90	5·42	6·24	1·82	2·41	8·09	9·60	7·95	57·72
Means	8·46	5·93	5·54	2·87	1·83	3·19	2·77	2·76	4·35	4·06	9·20	7·50	58·46

During 1894-1915 (10 years complete), average monthly snowfall was: Jan., 83·8 in.; Feb., 60·4; Mar., 54·7; April, 23·5; May, 7·0; Aug., 0·3; Sept., 2·1; Oct., 16·4; Nov., 85·8; Dec., 74·8. Mean annual snowfall, 408·7 in.; maximum recorded, 136·5 in., Dec., 1912.

100 GLENEMMA

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2·94	0·45	.....
1915	1·80	1·13	1·35	1·17	3·13	5·47	2·28	1·19	1·46	2·16	1·42	2·20	24·76

Snowfall in Nov., 1914, 5·0 in.; Dec., 4·5. In Jan., 1915, 18·0; Feb., 5·5; Nov., 10·5; Dec., 11·0; total in 1915, 45·0 in.

101 GOLDEN—Elevation, 2,550 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1902	.....	.....	.....	1·00	0·97	2·04	0·61	1·05	1·67	0·32	4·72	3·30	.....
1903	1·40	0·32	1·75	0·28	0·50	0·24	1·67	1·79	3·23	0·68	1·01	1·55	14·51
1904	1·20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1·20	1·20	.....
1908	.....	.....	.....	.....	.....	1·10	1·10	0·37	0·92	1·80	1·77	1·18	.....
1909	3·45	1·12	1·15	0·40	0·55	2·24	1·55	1·18	1·54	1·25	5·23	1·90	21·56
1910	1·15	3·08	1·88	1·70	0·68	1·97	0·22	1·64	1·60	2·16	2·66	1·25	20·99
1911	4·60	1·95	0·48	0·40	2·53	1·75	1·25	1·28	0·00	1·22	3·30	1·35	20·11
1912	1·93	0·45	0·15	0·78	0·73	1·29	3·75	3·02	1·02	0·73	2·10	1·78	18·65
1913	4·00	0·00	0·90	0·25	0·40	2·51	2·05	1·83	3·25	2·63	2·10	0·30	20·22
1914	3·65	0·20	1·38	0·75	1·10	1·09	0·42	0·45	1·73	1·35	1·67	0·75	14·54
1915	0·80	0·70	.....	.....	1·62	3·64	4·75	0·68	1·05	2·31	*	.....	.....
Means	2·47	0·98	1·10	0·69	1·02	1·79	1·74	1·42	1·60	1·55	2·58	1·46	18·40

* Observer resigned. New one started Feb., 1916.

During 1902-15 (complete record for 1903 and 1909-14), average monthly snowfall was: Jan., 24·2 in.; Feb., 9·7; Mar., 7·2; April, 1·6; Sept., 0·8; Oct., 1·1; Nov., 17·6; Dec., 13·1. Mean annual snowfall, 75·3 in.; maximum recorded, 46·0 in., Jan., 1911.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

GOLDSTREAM LAKE—Elevation, 1,505 ft.

102

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1894	......	......	......	......	......	......	......	0·29	6·12	9·40	8·63	4·83	......
1895	10·12	5·24	5·29	4·96	4·31	0·59	0·56	0·75	2·48	0·67	6·25	26·98	68·20
1896	19·22	14·03	3·94	2·50	3·76	1·28	0·00	0·92	1·61	4·25	19·66	16·60	87·86
1897	9·76	6·46	9·36	2·79	1·35	1·32	1·43	0·56	1·99	2·37	12·57	20·23	70·19
1898	5·72	11·80	2·70	2·30	0·92	2·39	0·51	0·45	3·74	5·29	11·90	8·34	56·06
1899	11·85	9·89	6·69	5·95	3·53	0·84	0·12	2·42	1·22	6·22	15·82	10·29	74·84
1900	10·70	6·52	12·01	3·05	2·64	4·44	1·27	1·24	2·03	8·96	8·61	12·97	74·44
1901	11·95	11·06	4·61	7·21	3·37	2·13	0·29	0·04	1·82	4·56	14·83	10·01	71·88
1902	7·74	11·20	7·10	5·40	1·85	0·80	1·62	1·03	3·24	3·29	13·45	16·53	73·25
1903	8·91	3·80	7·69	3·43	2·03	2·05	0·73	1·96	5·83	4·79	14·17	5·83	61·22
1904	10·81	11·06	11·98	2·18	2·01	1·36	1·71	0·93	1·06	2·55	13·00	16·07	74·72
1905	9·36	6·10	7·46	0·98	5·09	2·50	0·26	1·53	6·57	7·08	4·40	6·25	57·58
1906	9·33	5·04	1·54	1·44	2·04	1·91	0·28	0·77	7·53	12·17	14·04	9·16	65·25
1907	7·16	7·24	4·81	5·46	0·87	1·11	0·58	0·65	1·61	1·35	13·42	12·04	55·90
1908	10·89	9·79	9·61	3·79	2·75	0·10	0·34	1·18	0·97	5·22	11·51	13·97	70·12
1909	11·46	9·23	3·59	1·41	2·40	1·01	2·09	1·64	1·36	5·20	25·08	9·68	74·15
1910	12·94	10·20	5·26	3·69	1·45	1·69	0·02	0·73	2·14	0·03	16·31	11·32	74·78
1911	10·38	2·41	3·81	1·86	2·40	1·03	0·16	0·76	2·66	1·43	12·39	7·30	46·59
1912	9·34	7·34	2·08	2·48	1·83	1·98	0·99	2·89	1·39	4·22	11·45	12·07	58·06
1913	10·16	3·42	4·93	1·92	1·90	2·24	0·97	0·88	3·22	5·02	12·60	3·91	51·17
1914	17·53	3·46	4·88	2·63	0·97	2·34	0·22	0·42	3·57	7·97	12·85	1·73	58·57
1915	3·50	3·57	2·91	2·85	2·55	0·37	1·94	0·09	0·93	11·02	10·52	13·37	53·62
Means	10·42	7·56	5·82	3·25	2·38	1·59	0·77	1·01	2·87	5·14	12·89	11·34	65·04

During 1895-1915, average monthly snowfall was: Jan., 26·5 in.; Feb., 11·9; Mar., 8·8; April, 1·7; Nov., 5·7; Dec., 14·7. Mean annual snowfall, 69·3 in.; maximum, 86·0 in., Feb., 1904.

GRAND FORKS—Elevation, 1,746 ft.

103

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909	......	......	......	......	......	......	......	......	1·18	1·17	1·68	0·92	......
1910	0·83	1·11	1·03	0·29	1·21	1·45	0·08	0·64	0·82	0·75	1·45	2·16	11·82
1911	1·49	0·89	0·54	0·83	3·43	2·78	0·49	0·52	0·85	0·08	2·51	2·84	17·25
1912	2·05	1·55	0·15	1·31	1·78	2·13	2·81	2·28	1·10	0·75	3·28	1·42	20·61
1913	2·89	0·13	0·72	0·28	2·21	3·39	0·92	0·71	1·18	1·80	2·03	0·50	16·76
1914	2·00	0·90	1·26	1·97	0·89	2·22	0·15	0·00	1·89	1·18	1·89	1·70	16·35
1915	0·72	0·99	1·19	1·99	3·61	1·82	3·44	0·05	0·89	1·21	0·97	1·25	18·13
Means	1·66	0·93	0·82	1·11	2·19	2·30	1·37	0·70	1·13	0·99	1·97	1·54	16·71

During 1909-15 (1909 incomplete), average monthly snowfall was: Jan., 14·3 in.; Feb., 5·7; Mar., 2·3; April, 0·5; Oct., 1·3; Nov., 5·8; Dec., 13·8. Mean annual snowfall, 43·7 in.; maximum recorded, 28·9 in., Jan., 1913.

GRAND FORKS *—Elevation, 1,750 ft.

104

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	0·57	2·46	1·45	2·08	0·49	......
1914	2·60	1·39	0·88	1·88	0·70	1·34	0·34	0·00	1·69	1·04	2·15	2·02	16·03
1915	1·00	1·19	1·15	2·06	4·41	1·64	4·10	0·10	0·69	1·33	1·00	1·76	20·43

Snowfall in Nov., 1913, 2·5 in.; Dec., 4·9. In Jan., 1914, 10·4; Feb., 4·5; Mar., 1·2, Nov., 0·5; Dec., 10·2; total in 1914, 26·8. In Jan., 1915, 4·0; Feb., 1·7; Nov., 2·7; Dec., 7·5; total in 1915, 15·9 in.

GRAND PRAIRIE—Elevation, 2,157 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1882	......	......	......	......	......	......	......	......	......	......	0·48	0·70	......
1883	2·39	1·64	0·41	0·45	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1889	......	......	......	......	......	......	0·37	0·99	0·78	1·71	0·42	1·08	......
1890	0·50	0·75	0·52	0·15	1·49	2·41	1·78	1·95	0·59	1·31	0·88	0·94	13·27

Snowfall in Nov., 1882, 4·6 in.; Dec., 4·0. In Jan., 1883, 23·2; Feb., 14·0; Mar., 3·6. In Nov., 1889, 1·0; Dec., 10·8. In Jan., 1890, 5·0; Feb., 7·5; Mar., 3·2; April, 0·5; Dec., 3·0; total in 1890, 19·2 in.

GREENWOOD—Elevation, 2,400 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	......	......	......	......	......	1·94	1·94	1·56	......	......	......	......	......
1912	......	......	......	......	......	1·26	2·43	3·03	1·12	0·71	1·70	0·82	......
1913	0·98	0·05	0·33	0·45	2·59	2·91	1·25	1·29	1·54	1·05	0·56	0·59	13·59
1914	4·21	0·48	0·98	1·81	1·44	1·80	0·49	0·01	2·74	......	1·35	1·85	......
1915	1·25	1·10	0·92	2·40	4·24	1·59	3·25	0·61	0·71	0·80	1·20	3·63	21·70
Means	2·15	0·54	0·74	1·55	2·76	1·90	1·87	1·30	1·53	0·85	1·20	1·72	18·11

During 1912-15 (1913 and 1915 complete), average monthly snowfall was: Jan., 20·6 in.; Feb., 2·4; Mar 3·3; April, 0·2; Oct., 3·2; Nov., 7·1; Dec., 14·7. Mean annual snowfall, 51·5 in.; maximum recorded, 39·4 in., Jan., 1914.

* Another record, station in city.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

107 GRIFFIN LAKE—Elevation, 1,517 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	1·00	4·20	T	0·00	2·94	1·04	2·00	0·60	1·80	4·85	4·93		
1894	......	......	3·10	0·61	0·80	0·80	0·50	0·10	0·85	......	......	......	......
1895	2·90	3·47	0·20	3·00	0·00	......	......	0·00	......	......	1·30	6·80	......
1896	1·75	1·85	1·11	0·50		......	......		......	......	1·11	0·00	......
1897	......	1·50	0·95	......	......	......	......	......	......	......	......	5·89	......
1898	8·00	3·43	2·25	1·52	2·27	1·52	5·69	0·00	2·06	2·88	3·60	5·28	38·50
1899	6·95	5·03	2·03	0·74	4·04	3·42	1·49	3·61	1·31	1·20	6·30	3·65	39·77
1900	1·82	8·72	5·80	5·40	4·81	6·00	1·89	11·39*	2·81	6·78	5·05	4·22	64·69
Means	3·74	4·03	1·93	1·68	2·48	2·56	2·31	2·62	1·77	3·93	3·72	4·31	35·08

* Aug., 1900. Very wet month—rained on 18 days. On Aug 18, 3·2 inches of rain were recorded.

During 1893-1900 (complete records for 1898-1900), average monthly snowfall was: Jan., 29·8 in.; Feb., 33·5; Mar., 12·6; April, 0·8; Oct., 1·1; Nov., 20·4; Dec., 28·1. Mean annual snowfall, 126·3 in.; maximum recorded, 80·0 in., Jan., 1898.

108 HARRISON SPRINGS—Elevation, 50 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1889	......	......	......	......	......	......	3·18	4·07	6·66	5·04	7·39	4·80	......

The only snowfall recorded is a trace in Dec., 1889

109 HARPERS CAMP—Elevation, 2,400 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	2·04	1·45	0·50	1·68	0·35	1·87	0·86	......
1915	0·46	0·45	0·68	0·34	2·61	3·82	1·95	0·71	2·38	2·34	1·66	1·52	18·92

Snowfall in Nov., 1914, 9·7 in.; Dec., 8·6 in. In Jan., 1915, 3·5; Feb., 1·0; Nov., 13·5; Dec., 13·0; total in 1915, 31·0 in.

110 HARPERS RANCH—Elevation, 1,245 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	1·82	0·63	0·15	0·20	5·00	2·40	1·72	1·47	0·43	......	......	......	......

Snowfall in Jan., 1913, 18·2 in.; Feb., 4·8; Mar., 1·5; April, 1·0 in.

111 HARTLEY BAY—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1905	......	......	......	......	......	......	......	......	......	......	27·73	33·44	......
1906	33·49	7·51	7·85	16·04	2·87	6·39	......	6·59	21·30	23·75	14·00	10·60	......
1907	6·55	8·99	5·25	7·24	4·58	2·96	1·26	1·41	1·06	2·83	16·11	......	......
Means	20·02	8·25	6·55	11·64	3·73	4·67	1·26	4·00	11·18	13·29	19·28	22·02	125·89

Snowfall in Nov., 1905, 0·5 in.; Dec., 2·5. In Jan., 1906, 49·5; Feb., 4·8; Dec., 29·0. In Jan., 1907, 53·0; Feb., 17·0; Mar., 44·5; April, 0·5; Nov., 3·0 in.

112 HATZIC—Elevation, 32 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	......	......	......	......	......	......	......	......	......	4·72	17·86	11·45	......
1897	13·69	7·92	5·50	4·21	4·51	4·34	2·82	0 32	4·82	4·12	12·05	12·20	76·50
1898	9·60	11·33	......	......	......	......	......	......	......	......	......	......	......

Snowfall in Nov., 1896, 4·1 in. In Jan., 1897, 4·0; Mar., 7·8; Nov., 8·5; Dec., 0·6; total in 1897, 20·9. In Jan., 1898, 0·6; Feb., 1·0 in.

113 HAZELMERE—Elevation 200 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	......	......	1·37	6·03	5·77	2·40	0·76	0·27	1·22	4·12	9·66	9·03	......
1894	8·53	3·87	6·48	8·79	4·[illegible]2	4·90	0·52	T	5·89	6·28	8·15	4·22	61·95
1895	6·48	5·14	3·36	2·89	3·92	2·46	0·21	0·41	5·23	0·39	5·09	6·97	42·55
1896	6·07	4·97	1·63	4·35	2·87	2·14	0·00	0·81	1·18	3·61	8·63	10·27	47·43
1897	5·34	4·41	4·80	2·88	4·19	3·10	2·49	0·79	2·64	2·01	......	9·20	......
1898	4·54	7·64	2·70	2·73	1·95	3·42	0·60	0·80	3·10	4·54	7·68	3·52	43·24
1899	9·50	6·01	2·97	3·83	4·41	1·54	0·89	4·57	11·72	5·41	10·07	8·47	58·81
1900	5·89	4·22	6·83	3·71	3·75	5·29	1·20	2·05	2·19	4·92	3·50	4·89	48·44
1901	4·86	2·48	2·07	5·35	3·47	3·15	1·23	......	......	......	......	......	......
Means	6·53	4·84	3·58	4·51	3·85	3·16	0·88	1·21	3·15	3·91	7·54	7·07	50·23

During 1893-1901 (complete record for 1894-96 and 1898-1900), average monthly snowfall was: Jan., 7·2 in.; Feb., 3·7; Mar., 6·4; Nov., 3·0; Dec., 2·2. Mean annual snowfall, 22·5 in.; maximum recorded, 23·9 in., Mar., 1897.

114 HAZELTON—Elevation, 725 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	......	......	......	......	......	......	......	......	0·38	......	......	......	......
1897	......	......	......	......	3·03	1·83	3·26	......	......	3·80	0·49	0·57	......

Snowfall in Nov., 1897, 3·8 in.; Dec., 5·7 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

HEDLEY—Elevation, 1,771 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	......	......	......	......	0·15	1·10	1·08	0·76	T	0·46	0·54	0·70	......
1905	0·45	0·48	0·50	0·71	0·80	0·91	2·50	0·86	0·80	1·02	0·73	0·46	10·22
1906	1·11	0·96	0·36	0·30	3·47	2·25	......	0·34	0·35	0·37	2·40	1·60	......
1907	0·40	0·68	0·33	0·15	1·41	0·72	0·76	1·51	1·82	0·19	0·33	0·43	8·73
1908	0·62	0·54	0·60	0·43	1·54	0·48	0·78	1·28	0·47	0·51	0·22	0·67	8·14
1909	0·91	3·06	0·18	0·33	2·40	1·27	3·10	0·06	0·52	1·06	2·12	0·28	15·29
1910	0·78	0·84	0·41	0·05	1·17	1·66	0·55	1·24	0·51	0·61	0·94	1·15	9·91
1911	2·92	0·77	0·56	0·09	2·89	1·98	0·32	1·64	1·41	0·21	1·08	1·40	15·67
1912	0·72	3·16	0·09	1·36	0·58	1·25	1·32	1·40	0·58	0·83	0·55	0·82	12·66
1913	1·38	0·40	0·94	0·63	1·18	2·24	0·37	0·83	0·32	1·72	0·36	0·35	10·72
1914	1·26	0·58	0·36	0·66	1·66	1·41	0·86	0·12	1·02	0·66	1·44	1·15	11·18
1915	0·25	0·54	0·53	0·65	3·35	1·18	2·29	0·71	1·32	1·13	0·38	1·23	13·56
Means	0·98	1·09	0·44	0·49	1·72	1·37	1·27	0·90	0·76	0·73	0·92	0·85	11·52

During 1905-15, average monthly snowfall was: Jan., 5·6 in.; Feb., 5·0; Mar., 1·6; April, 0·5; Oct., 0·3 Nov., 2·9; Dec., 7·7. Mean annual snowfall, 23·6 in.; maximum recorded, 16·0 in., Dec., 1906.

HEDLEY, NICKEL PLATE MINE—Elevation, 4,500 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	......	2·63	2·15	2·73	1·16	2·87	1·60	0·94	0·16	1·16	0·96	1·16	......
1905	1·29	0·41	2·01	1·68	2·87	2·51	4·14	0·79	1·59	2·05	1·15	0·73	21·22
1906	1·08	1·26	1·45	0·50	7·30	1·77	1·01	0·38	1·41	1·79	5·45	4·10	27·50
1907	1·75	1·43	2·25	1·00	3·32	1·78	0·90	2·43	1·93	0·00	1·00	1·60	19·39
1908	2·50	2·70	2·00	2·55	4·70	1·95	1·43	2·36	0·61	......	......	1·15	......
1909	......	......	......	0·15	......	......	......	......	......	......	......	1·40	......
1910	2·90	3·30	0·70	1·40	1·30	2·78	0·75	2·16	1·07	1·10	3·80	3·70	24·96
1911	1·80	2·30	0·90	1·80	10·75	3·28	0·51	2·40	......	......	4·40	2·90	......
1912	2·65	2·26	0·56	......	2·25	4·15	2·58	1·98	1·00	1·65	0·90	3·30	......
1913	3·25	0·60	0·65	1·50	1·11	3·51	0·41	1·25	0·45	2·90	0·75	0·85	17·23
1914	3·45	1·70	1·10	1·50	2·70	2·04	0·15	0·04	5·40	1·36	2·03	1·95	23·42
1915	0·80	0·60	0·80	2·06	0·81	1·30	2·25	0·25	2·02	1·73	3·15	3·80	19·57
Means	2·15	1·74	1·32	1·53	3·48	2·54	1·43	1·36	1·56	1·53	2·36	2·22	23·22

During 1904-15 (6 years complete), average monthly snowfall was: Jan., 21·3 in.; Feb., 17·4; Mar., 12·8; April, 13·3; May, 23·3; June, 8·4; July, 1·4; Aug., 1·2; Sept., 0·7; Oct., 10·4; Nov., 23·2; Dec., 22·1. Mean annual snowfall, 161·5 in.; maximum recorded, 101·5 in., May, 1911.

HOLBERG (FORMERLY CAPE SCOTT)—Elevation, near sea-level

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1897	......	......	......	7·41	5·76	5·25	5·77	4·61	5·18	11·88	8·19	11·42	......
1898	16·60	15·65	4·18	11·43	6·46	4·39	2·79	0·35	6·63	9·39	14·87	9·51	102·25
1899	12·82	8·58	5·61	8·97	4·68	1·05	0·68	1·18	12·65	12·45	2·76	24·09	95·52
1900	16·49	10·67	10·70	......	......	......	......	......	......	......	......	......	......
1901	......	......	......	......	......	3·34	4·91	3·27	2·25	16·73	28·59	17·45	......
1902	12·84	21·37	14·95	7·56	4·67	3·23	3·33	6·13	7·97	10·15	17·54	26·06	135·80
1903	13·90	7·13	4·24	13·03	6·20	3·96	0·43	3·85	9·90	7·09	20·94	19·66	110·33
1904	12·83	12·40	5·46	4·21	4·93	2·74	1·91	R	5·98	13·16	27·74	14·39	105·75
1905	12·54	11·72	12·95	3·37	5·56	0·75	1·00	6·80	14·10	11·06	17·16	20·59	117·60
1906	15·30	8·35	9·44	7·96	3·22	6·06	0·00	4·92	14·02	12·11	12·29	19·74	113·41
1907	5·00	14·43	10·41	11·27	6·07	2·58	1·22	7·60	6·00	7·89	22·32	18·55	113·34
1908	13·64	9·40	13·65	11·02	8·60	4·22	4·86	2·57	7·17	8·52	20·25	11·37	115·27
1909	9·99	11·37	10·77*	5·42	6·01	3·68	5·17	15·76	7·73	21·27	22·60	9·13	128·90
1910	22·84	9·98	15·41	11·58	7·58	5·72	1·55	2·31	5·67	17·98	20·15	25·73	146·50
1911	13·08	13·80	12·32	3·09	4·04	6·10	1·50	2·83	8·82	12·67	21·80	23·56	123·61
1912	20·53	15·44	2·87	10·41	4·74	2·86	1·71	2·38	3·66	17·84	24·55	19·05	126·07
1913	13·22	5·88	5·84	10·77	11·22	4·61	5·16	5·16	......	11·70	23·40	26·39	......
1914	23·89	9·51	17·94	11·80	7·15	2·06	3·50	2·66	6·97	19·56	26·47	5·57	137·08
1915	10·98	14·73	9·71	14·12	5·73	1·67	3·49	3·55	5·16	24·99	18·34	23·18	135·65
Means	14·53	11·80	9·78	9·03	6·41	3·57	2·72	4·22	7·64	13·70	19·41	18·08	120·89

* In April, 1909, recording station moved from Cape Scott to Holberg.

Snowfall in Mar., 1904, 9·1 in. In Jan., 1913, 11·5. Total in 1915, 4·7 in., all in Dec.
Very little snowfall at this station—it usually melts as it falls and is recorded as rain.

HOLT CREEK—Elevation, 300 ft.

118

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	......	......	......	......	7·21	10·78	2·04	......
1915	5·21	3·69	2·65	3·12	3·17	0·47	0·78	0·13	0·56	8·03	8·76	3·67	40·24

Snowfall in Nov., 1914, 3·0 in.; Dec., 2·0. In Jan., 1915, 0·2; Nov., 1·2; Dec., 4·2; total in 1915, 5·6 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

HOPE—Elevation, 500 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	3·79	6·16	3·74	3·56	3·53	0·88	0·98	0·36	3·76	8·23	10·34	3·31	48·64
1879	9·15	13·75	11·73	2·23	3·43	2·18	5·45	1·55	3·61	9·56	0·74	10·83	74·23
1880	14·03	5·29	4·42	1·87	1·95	1·33	3·62	1·74	2·33	2·08	......	......	....
1881	......	......	......	......	......	......	......	......	......	......	......	......	....
1882	......	......	......	3·36	1·63	1·45	......	......	......	......	......	......	....
......	......	......	......	......	......	......	......	......	......	......	......	......	....
1910	......	......	5·67	2·85	2·69	0·83	0·11	0·97	2·74	10·80	11·99	8·21	....
1911	6·97	3·24	2·78	1·87	2·40	0·75	0·46	3·39	6·23	1·33	12·49	6·14	48·05
1912	6·44	5·08	1·14	1·43	0·71	1·67	2·84	4·09	0·70	6·58	10·19	4·77	45·64
1913	10·39	3·50	3·86	1·88	2·80	2·75	2·54	1·91	6·77	7·40	9·91	1·88	55·59
1914	10·94	4·31	5·01	3·62	3·10	1·96	0·11	0·79	4·29	3·83	10·25	1·70	49·91
1915	2·52	3·59	1·71	2·62	4·12	1·13	1·13	0·12	2·08	4·33	8·57	11·11	43·03
Means	8·03	5·62	4·45	2·53	2·61	1·49	1·92	1·66	3·61	6·02	9·31	5·99	53·27

During 1879-1915 (1881-1909 no record), average monthly snowfall was: Jan., 40·2 in.; Feb., 15·1; Mar., 3·4; April, 0·9; Nov., 10·6; Dec., 12·2. Mean annual snowfall, 82·4 in.; maximum recorded, 92·5 in., Jan., 1913.

HORNBY ISLAND—Elevation, 40 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	......	......	......	......	......	......	......	......	......	......	......	9·38	....
1908	11·75	6·04	3·19	2·00	1·42	1·00	0·97	0·19	0·55	3·23	12·45	4·05	46·48
1909	2·46	3·52	1·11	0·01	0·43	0·33	1·27	0·12	1·30	......	......	......	....
1910	......	......	......	0·45	1·01	2·12	0·00	1·43	......	......	......	......	....
1911	1·00	0·90	0·36	2·47	3·68	0·72	0·22	0·75	2·20	2·90	6·41	4·30	25·91
1912	8·81	6·31	0·61	1·35	2·03	1·07	1·35	3·51	2·13	3·31	11·66	7·19	49·33
1913	7·09	2·42	2·20	1·90	1·20	2·15	1·39	0·79	4·51	4·68	13·92	2·91	45·16
1914	14·14	5·80	3·66	4·15	0·68	2·58	0·27	0·90	4·89	12·05	10·71	2·78	62·61
1915	5·54	4·74	2·62	3·02	2·16	0·58	0·36	0·00	0·94	8·25	7·02	12·48	47·71
Means	7·26	4·25	1·96	1·92	1·58	1·32	0·73	0·96	2·36	5·74	10·36	6·16	44·60

During 1907-1915 (complete record for 1912-15), average monthly snowfall was: Jan., 9·5 in.; Feb., 0·7; Mar., 0·5; Nov., 4·4; Dec., 0·7. Mean annual snowfall, 15·8 in.; maximum recorded, 34·0 in., Jan., 1913.

HOWSER—Elevation, 1,875 ft.

121

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	......	1·25	1·93	2·54	1·80	....
19[illegible]	4·10	1·08	0·19	1·76	0·90	2·10	1·54	2·81	3·02	1·74	1·51	0·30	21·05
19[illegible]	4·75	0·30	1·41	1·18	0·97	2·19	1·51	0·32	......	......	......	......	....

Snowfall in Nov., 1912, 1·8 in.; Dec., 18·0. In Jan., 1913, 41·0; Feb., 4·3; Mar., 1·0; Nov., 7·0; Dec., 3·0 in. In Jan., 1914, 27·0; Feb., 3·0; Mar., 9·5 in.

106-MILE HOUSE—Elevation, 3,000 ft.

122

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	1·58	4·15	0·18	1·34	2·24	0·00	....
1914	1·88	2·68	0·46	0·00	0·35	2·64	1·32	0·00	2·92	0·39	0·60	1·90	15·14
1915	0·50	0·00	0·44	0·30	2·07	2·60	2·83	0·20	0·63	0·23	0·35	0·62	10·77

Snowfall in Nov., 1913, 8·7 in. In Jan., 1914, 11·7; Feb., 14·5; Mar., 2·5; May, 3·5; Nov., 6·0; Dec., 19·0; total in 1914, 57·2. In Jan., 1915, 5·0; Dec., 6·2; total in 1915, 11·2 in.

HYDRAULIC—Elevation, about 2,000 ft.

123

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	1·01	0·96	1·16	2·90	4·49	0·61	1·61	0·70	0·80	....
1913	4·00	0·88	2·07	0·56	1·23	2·10	2·41	3·69	2·46	2·80	1·08	0·25	23·53
1914	3·10	1·95	1·06	0·77	0·89	2·39	2·47	0·23	1·97	0·15	1·86	1·35	18·19
1915	0·20	......	......	......	......	......	......	......	......	......	......	......	....

During 1912-15 (1913 and 1914 complete), average monthly snowfall was: Jan., 21·7 in.; Feb., 12·0; Mar., 10·4; Nov., 7·9; Dec., 7·2. Mean annual snowfall, 59·2 in.; maximum recorded, 40·0 in., Jan., 1913.

HYDRAULIC (SWIFT RIVER DAM)—Elevation, 2,700 ft.

124

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	......	......	......	......	......	......	......	......	......	......	......	4·50	....
1911	3·75	1·50	1·05	1·03	1·49	3·92	2·30	2·21	2·07	0·65	3·51	4·85	28·33
1912	......	0·93	0·80	1·71	1·15	1·16	2·70	3·62	0·97	2·39	1·59	2·33	....
1913	4·80	0·83	1·98	......	0·41	2·49	2·66	4·41	3·45	3·05	......	......	....
Means	4·28	1·09	1·28	1·37	1·02	2·52	2·55	3·41	2·16	2·03	2·55	3·89	28·15

During 1910-13, average monthly snowfall was: Jan., 42·8 in.; Feb., 10·9; Mar., 12·3; April, 4·2; Nov., 21·4; Dec., 35·0. Total snowfall in 1911, 148·1 in.; maximum recorded, 48·0 in., Jan., 1913.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

IKEDA BAY—Elevation, 5 ft.

125

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1908	......	......	......	......	......	......	4·23	5·72	11·43	18·02	17·28	11·25	......
1909	16·60	9·94	10·79	2·58	7·08	3·67	9·50	10·14	13·54	9·45	15·28	7·61	116·1[illegible]
1910	24·85	13·98	11·98	15·53	8·80	6·27	0·86	......	4·04	7·61	7·42	8·80	......
1911	11·72	6·51	......	......	6·06	4·16	3·23	0·50	4·52	4·39	8·06	......	......
1912	16·61	16·89	2·00	4·45	......	2·05	......	1·61	3·35	7·10	8·70	9·85	......
1913	6·79	3·05	5·00	6·67	9·70	0·60	......	......	7·86	10·57	21·15	32·35	......
1914	20·12	17·05	22·96	18·58	1·52	1·85	8·22	2·00	3·59	13·01	18·78	7·69	135·3[illegible]
1915	7·69	4·39	12·26	8·85	5·37	0·54	2·04	7·24	3·55	9·79	15·12	9·12	85·9[illegible]
Means	14·91	10·26	10·83	9·44	6·42	2·73	4·68	4·54	6·49	9·99	13·97	13·16	107·4[illegible]

During 1908-15 (5 years complete), average monthly snowfall was: Jan., 16·4 in.; Feb., 5·6; Mar., 2·6; Apr[illegible] 0·4 ; Oct., 0·4 ; Nov., 1·2 ; Dec., 2·7 Mean annual snowfall, 29·3 in.; maximum recorded, 58·2 in., Jan., 190[illegible]

INVERMERE (COMFORT RANCH)—Elevation, 3,340 ft.

126

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	0·72	1·79	0·42	0·86	0·39	......
1914	1·53	0·50	1·02	1·05	1·22	2·02	1·21	0·55	2·39	0·74	1·26	0·38	13·8[illegible]
1915	0·58	0·34	0·18	1·55	0·80	3·93	3·56	0·69	0·95	0·60	0·27	0·07	13·5[illegible]

Snowfall in Nov., 1913, 4·7 in.; Dec., 3·9. In Jan., 1914, 7·1 ; Feb., 5·0 ; Mar., 8·4 ; Nov., 3·0 ; Dec., 3·[illegible] total in 1914, 29·3. In Jan., 1915, 5·8 ; Feb., 3·4 ; Mar., 0·7 ; Nov., 0·6 ; Dec., 0·7 ; total in 1915, 11·2 in.

INVERMERE (DOMINION EXPERIMENTAL FARM)—Elevation, 2,650 ft.

127

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	......	......	......	0·71	1·36	......
1913	1·34	2·08	0·35	1·78	0·67	1·71	1·60	1·84	1·89	0·61	0·78	0·12	14·77
1914	1·80	0·50	0·40	1·25	1·46	1·59	1·57	0·75	2·16	0·77	0·79	0·43	13·47
1915	0·51	0·30	0·03	1·14	1·01	3·92	3·79	0·67	0·72	0·90	0·90	0·58	14·47

During 1912-15 (1912 incomplete), average monthly snowfall was : Jan., 9·7 in. ; Feb., [illegible]·9 ; Mar., 2·3 ; Apr[illegible] 0·6 ; Nov., 6·1 ; Dec., 2·5. Mean annual snowfall, 24·1 in.; maximum recorded, 13·4 in., Jan., 1913.

INVERMERE HEIGHTS—Elevation, about 2,600 ft.

128

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	0·44	0·78	0·12	......
1914	2·00	0·91	0·48	1·04	1·46	1·54	1·46	0·81	2·16	0·70	0·58	0·41	13·5[illegible]
1915	0·43	0·48	0·05	1·18	0·86	4·16	4·04	0·66	0·69	0·97	0·57	0·52	14·61

Snowfall in Jan., 1914, 13·4 in.; Feb., 9·1 ; Mar., 3·0 ; Nov., 4·5 ; Dec., 4·1 ; total in 1914, 34·1 in. In Jan[illegible] 1915, 4·3 ; Feb., 4·8 ; Sept., 0·7 ; Nov., 5·7 ; Dec., 3·7 ; total in 1915, 19·2 in.

JAMES ISLAND—Elevation, near sea-level

129

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	1·70	0·62	1·35	0·26	2·16	0·02	0·09	2·15	3·49	5·40	0·89	......
1915	1·69	1·03	1·54	0·97	1·37	0·48	0·81	0·23	0·48	3·35	4·08	5·97	22·00

JONES LAKE*—Elevation, 2,050 ft.

130

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	......	......	......	......	6·98	4·74	0·31	2·82	2·39	14·15	17·18	10·18	......
1911	14·64	4·83	5·22	4·17	6·36	2·67	3·26	3·14	10·12	2·10	17·51	7·83	81·85
1912	8·81	8·72	2·36	3·36	3·95	4·44	5·86	7·04	2·07	7·58	12·83	11·92	78·94
1913	12·67	6·76	7·27	3·36	5·24	4·48	7·03	2·98	10·11	9·98	12·04	2·76	84·68
1914	15·19	4·46	8·86	6·22	7·15	5·21	1·06	0·89	7·01	5·50	14·75	2·31	78·61
1915	5·45	4·23	3·56	5·36	6·50	4·11	2·56	0·36	2·54	15·15	9·93	13·98	73·73
Means	11·35	5·80	5·45	4·49	6·03	4·27	3·35	2·87	5·71	9·08	14·04	8·46	80·90

During 1910-15 (1912-15 complete), average monthly snowfall was : Jan., 59·4 in.; Feb , 17·8 ; Mar., 17·4 April, 13·2 ; Oct., 2·0 ; Nov., 20·5 ; Dec., 27·6. Mean annual snowfall, 152·6 in.; maximum recorded, 120·0 in. Jan , 1913.

Snowfall reduced to equivalent rainfall by use of factor 12 to 1 up to March 31, 1914.
Snowfall reduced to equivalent rainfall by use of factor 10 to 1 from April 1, 1914.

JORDAN RIVER (SHIRLEY)—Elevation, near sea-level

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	......	......	......	......	......	......	......	......	......	......	......	13·41	......
1908	11·14	9·41	14·46	5·50	2·98	0·99	0·22	1·90	1·36	5·74	12·45	10·95	77·19
1909	9·00	10·40	6·49	2·48	3·56	1·32	1·77	2·13	2·02	6·15	21·80	12·13	79·25
1910	11·49	7·65	5·92	4·69	1·61	1·64	0·13	0·58	2·93	11·49	16·50	14·18	78·83
1911	11·07	4·24	3·90	3·10	4·17	1·27	0·40	0·60	4·52	1·86	19·76	8·80	63·69
1912	9·38	6·63	2·22	1·95	2·07	2·91	1·10	3·21	2·50	4·91	9·77	13·68	60·33
1913	10·92	4·90	4·99	2·38	3·06	3·74	1·92	0·44	5·27	9·24	15·60	3·67	66·13
1914	17·51	5·96	5·50	4·03	1·73	3·91	0·32	0·98	4·62	10·47	14·45	2·42	71·92
1915	5·11	4·50	4·33	3·62	2·43	0·27	1·06	0·60	0·61	13·59	9·80	14·38	59·92
Means	10·70	6·71	5·98	3·48	2·70	2·01	0·87	1·30	2·98	7·93	13·02	10·40	70·05

During 1908-15, average monthly snowfall was : Jan., 1·4 in.; Feb., 1·0 ; Mar., 0·4 ; Nov., 1·1 ; Dec., 0·4. Mean annual snowfall, 4·3 in.; maximum recorded, 8·5 in., Nov., 1911.

* Records supplied by British Columbia Electric Railway Co.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

132 JORDAN RIVER (BEAR CREEK)—Elevation, 3,670 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	......	......	......	......	......	......	......	......	......	......	13·86	15·66	......
1911	15·03	5·47	5·59	4·00	5·26	2·06	0·50	1·37	5·59	3·62	21·28	14·40	84·17
1912	16·37	11·11	1·97	2·90	2·53	3·52	0·99	3·82	3·26	8·70	21·79	18·78	94·74
1913	16·70	9·30	9·17	3·53	3·57	3·74	2·21	0·66	7·79	9·53	18·24	6·92	91·36
1914	30·29	5·65	10·07	6·02	2·52	4·48	0·33	1·23	6·03	14·27	23·71	3·67	108·27
1915	7·06	6·58	6·33	6·84	3·85	0·47	2·27	0·37	1·15	24·16	15·76	20·35	95·19
Means	17·09	7·62	6·63	4·66	3·55	2·65	1·26	1·49	4·76	12·06	19·11	13·30	94·18

During 1910-15 (1910 incomplete), average monthly snowfall was: Jan., 50·8 in.; Feb., 10·9; Mar., 6·8; April, 3·5; Oct., 0·5; Nov., 9·0; Dec., 15·7. Mean annual snowfall, 97·2 in.; maximum recorded, 104·5 in., Jan., 1913.

133 KAMLOOPS—Elevation, 1,245 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	0·35	1·33	0·68	0·30	1·86	1·22*	1·16	0·12	0·63	0·86	1·62	0·92	11·05
1879	0·84	1·50	1·00	0·45	1·51	3·07	3·42	1·52	0·19	0·55	1·72*	0·84*	16·61
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1887	......	......	......	......	......	......	......	......	......	1·60	0·23	0·35	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1890	......	......	......	......	......	......	......	......	......	......	......	......	......
1891	0·12	0·18	0·19	0·07	......	......	0·60	0·36	......	......	......	T	......
1892	......	......	......	......	......	......	......	......	......	......	......	......	......
1893	0·40	0·79	......	......	......	1·22	......	......	......	......	1·50	1·10	......
1894	......	......	......	......	......	......	......	......	......	......	......	......	......
1895	......	......	......	......	......	1·11	0·50	0·25	2·26	0·13	0·58	1·01	......
1896	1·93	0·80	0·47	0·99	0·97	0·57	0·60	0·42	0·91	0·44	2·52	0·91	11·53
1897	0·64	0·07	0·55	0·65	0·39	1·76	3·18	0·44	0·99	0·41	2·42	1·23	12·73
1898	1·00	0·90	0·83	T	1·67	0·83	0·88	0·00	0·72	1·41	1·44	0·12	9·80
1899	1·28	1·05	0·01	0·06	0·49	1·16	1·37	3·73	0·52	0·42	0·86	0·66	11·91
1900	0·44	0·26	0·27	0·18	1·79	1·63	1·78	2·22	0·36	0·64	0·51	0·56	10·84
1901	0·90	0·47	0·06	0·17	0·00	1·99	0·42	0·00	1·21	0·16	1·23	0·46	7·07
1902	1·04	1·24	0·36	0·46	2·51	1·10	0·83	0·86	1·26	T	0·72	1·62	12·00
1903	0·35	0·02	0·62	0·28	0·52	0·61	2·33	1·74	2·34	0·44	0·48	0·54	10·27
1904	2·71	2·48	0·50	1·07	T	1·22	1·02	0·38	0·12	0·02	0·44	0·82	10·78
1905	0·94	......	0·00	0·46	0·00	0·82	0·62	1·64	1·54	0·96	0·31	0·37	......
1906	0·72	0·25	0·10	0·08	1·79	1·49	0·35	0·00	0·61	1·28	2·38	2·04	11·09
1907	1·10	0·56	0·24	0·16	0·09	1·00	1·18	1·73	2·01	0·13	0·57	0·17	8·94
1908	0·52	0·97	0·29	0·26	0·91	0·89	0·48	1·46	0·10	0·65	0·07	0·90	7·50
1909	0·81	1·00	0·06	0·30	0·73	1·02	2·24	0·62	1·21	0·50	0·84	0·30	9·63
1910	0·22	0·87	0·18	0·12	0·62	1·18	0·29	1·60	0·43	0·66	0·65	0·87	7·69
1911	0·54	0·21	0·12	0·11	1·18	0·21	0·78	1·02	0·88	0·03	2·01	1·27	8·36
1912	1·18	0·62	0·00	1·36	0·32	1·52	3·50	2·09	0·86	0·66	0·82	0·54	13·47
1913	1·44	1·01	0·17	0·22	0·60	2·60	0·96	0·80	0·48	1·04	0·71	0·26	10·29
1914	1·68	2·18	0·26	0·38	1·31	0·54	0·53	0·38	1·09	0·79	1·01	0·58	10·73
1915	0·93	T	0·47	0·17	2·28	2·49	1·15	1·32	0·61	0·80	0·38	1·60	12·20
Means	0·92	0·82	0·32	0·36	0·98	1·30	1·26	1·00	0·88	0·61	1·04	0·77	10·26

* Interpolated.

During 1878-1915 (complete record for 21 years), average monthly snowfall was: Jan., 7·9 in.; Feb., 6·2; Mar., 1·1; Oct., 0·2; Nov., 6·6; Dec., 6·2. Mean annual snowfall, 28·2 in.; maximum recorded, 24·4 in., Feb., 1904.

134 KASLO—Elevation, 1,752 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	5·51	1·77	2·97	1·74	2·87	1·09	0·87	......	......	0·81	2·38	3·04	......
1896	5·86	2·66	0·77	......	......	......	......	......	......	......	4·14	3·51	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1912	......	......	0·50	0·93	1·37	1·16	4·03	1·92	1·29	2·97	5·00	1·78	......
1913	4·13	0·65	1·11	1·24	0·81	2·48	2·20	1·94	3·33	1·61	4·56	0·58	24·64
1914	7·17	1·26	1·65	2·07	1·72	1·32	1·17	0·00	3·23	1·75	2·76	2·20	26·30
1915	1·00	0·95	0·51	1·12	2·47	1·74	3·00	......	2·30	1·25	1·00	3·40	......
Means	4·73	1·46	1·25	1·42	1·85	1·56	2·25	1·29	2·54	1·68	3·31	2·42	25·76

During 1895-1915 (1897-1911 no record), average monthly snowfall was: Jan., 31·1 in.; Feb., 7·4; Mar., 6·1; April, 0·1; Nov., 9·2; Dec., 17·5. Mean annual snowfall, 71·4 in.; maximum recorded, 44·0 in., Jan., 1914.

135 KELOWNA (BANKHEAD ORCHARD)

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	0·35	0·95	0·81	0·26	0·23	2·52	1·05	2·12	0·45	......
1915	1·27	0·28	0·67	0·86	2·53	1·10	1·70	0·20	1·70	1·06	1·00	1·32	13·69

Snowfall in Nov., 1914, 1·3 in.; Dec., 4·5. In Jan., 1915, 12·3; Nov., 4·1; Dec., 11·7; total in 1915, 28·1 in.

136 KELOWNA (HYDRAULIC SUMMIT)—Elevation, 4,120 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	......	......	0·34	0·81	3·00	......
1913	3·00	1·25	0·56	0·81	1·65	6·22	1·47	1·78	1·70	3·12	0·58	1·00	23·14
1914	6·25	2·75	1·50	0·91	2·02	2·46	0·94	0·56	2·72	......	......	......	......
1915	1·75	0·00	2·00	2·27	5·00	1·70	2·38	0·85	0·89	0·46	1·82	1·75	20·87

Snowfall in Nov., 1912, 8·1 in.; Dec., 30·0. In Jan., 1913, 30·0; Feb., 12·5; Mar., 5·6; April, 8·1; Oct., 14·0; Nov., 5·8; Dec., 10·0; total in 1913, 86·0. In Jan., 1914, 62·5; Feb., 27·5; Mar., 15·0. In Jan., 1915, 17·5; Mar., 20·0 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

KELOWNA (OKANAGAN MISSION)—Elevation, 1,200 ft.

137

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	1·73	0·72	1·45	0·19	......	0·41	2·83	0·75	0·74	1·15	......	......	......
......	......	......	......	......									......
1893	......	......	......	......	1·91	1·24	0·91	0·17	1·87	......	2·36	......	......
1894	1·62	0·15	T	0·37	0·61	0·75	0·07	0·05	1·76	1·37	1·63	0·88	9·26
1895	1·21	0·70	0·56	1·04	2·24	0·62	0·32	0·18	2·25	0·07	1·12	1·89	12·20
1896	1·40	1·30	0·11	0·50	1·52	0·93	0·22	0·51	0·15	0·65	1·52	2·78	11·50
1897	1·24	1·09	0·86	0·59	0·41	1·54	1·55	......	......	......	......	......	......
1898	......	......	......	......	......	......	......	......	......	......	......	......	......
1899	......	......	0·66	0·44	0·93	1·01	0·56	2·51	1·52	0·90	2·09	1·13	......
1900	0·69	0·96	0·86	0·46	1·27	1·26	0·54	2·04	0·93	0·90	1·25	0·82	11·08
1901	......	3·04	0·27	0·54	0·58	0·70	0·53	0·00	......	......	......	......	......
1902	......	......	......	......	2·06	1·59	1·19	1·53	1·53	0·03	1·55	2·05	......
1903	1·20	0·07	2·34	0·30	0·22	2·21	3·48	1·28	1·76	0·62	1·46	1·05	15·99
1904	1·45	1·39	1·55	1·60	0·17	1·48	0·75	0·58	0·08	1·21	0·75	1·40	12·41
1905	1·16	0·18	0·81	0·26	1·22	1·62	0·47	0·19	2·00	1·48	0·75	1·08	11·31
1906	0·79	0·98	0·47	0·10	2·04	2·07	2·03	0·11	0·85	1·27	2·64	1·51	14·86
1907	1·65	0·93	1·21	0·10	1·45	1·37	0·55	1·74	2·23	0·27	0·70	1·12	13·32
1908	1·09	1·12	0·58	0·41	0·90	0·34	0·25	0·87	0·48	0·68	0·25	0·82	7·79
1909	1·10	1·23	0·21	0·15	0·93	1·79	2·35	0·52	1·81	1·31	1·22	0·50	13·12
1910	0·82	0·96	0·39	0·42	1·21	0·92	0·33	1·09	0·50	1·06	1·32	4·41	13·43
1911	1·19	0·58	0·19	0·20	1·09	1·76	0·39	1·16	0·99	0·18	3·21	1·45	12·39
1912	2·07	1·55	0·00	1·13	0·38	1·42	1·35	1·02	0·85	0·91	1·47	0·56	12·71
1913	1·70	1·15	0·26	0·13	1·91	2·33	0·55	1·27	0·28	2·27	0·84	0·95	13·64
1914	2·34	0·75	0·30	0·20	0·87	1·07	0·20	0·26	2·65	0·70	1·43	0·48	11·25
1915	1·15	0·36	0·82	0·79	2·55	0·88	1·89	0·26	1·65	1·21	1·31	1·23	14·10
Means	1·34	0·97	0·67	0·47	1·20	1·27	1·01	0·82	1·28	0·91	1·44	1·37	12·75

During 1893-1915 (17 years complete), average monthly snowfall was: Jan., 10·9 in.; Feb., 6·0; Mar., 3·0; April, 0·1; Nov., 5·0; Dec., 10·2. Mean annual snowfall, 35·2 in.; maximum recorded, 25·0 in., Dec., 1896.

KELOWNA (RUTLAND)—Elevation, 1,870 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	1·35	0·78	0·29	0·21	1·70	2·17	0·89	1·34	1·12	0·25	2·43	1·45	13·97
1912	1·15	1·15	0·00	1·11	0·43	1·48	2·02	0·86	1·06	1·02	1·18	0·70	12·16
1913	2·10	0·93	0·27	0·26	1·46	2·47	0·49	0·66	0·53	1·90	0·30	0·55	11·92
1914	1·92	1·13	0·36	0·68	1·00	1·44	0·56	0·64	2·58	0·39	1·00	0·85	12·55
1915	0·94	0·36	0·82	1·05	2·41	1·41	2·09	0·46	1·32	0·88	0·26	0·70	12·70
Means	1·49	0·87	0·35	0·66	1·40	1·79	1·21	0·79	1·32	0·89	1·03	0·85	12·65

During 1911-15, average monthly snowfall was: Jan., 12·0 in.; Feb., 5·1; Mar., 0·7; Nov., 4·4; Dec., 7·7. Mean annual snowfall, 29·9 in.; maximum, 21·0 in., Jan., 1913.

KEREMEOS (DOMINION STATION)—Elevation, 1,372 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1891	0·20	0·65	0·59	0·59	0·84	2·01	1·19	0·75	0·40	0·25	1·30	0·07	8·81
1892	0·02	0·22	1·03	0·44	0·29	1·47	0·53	0·53	0·00	1·06	2·36	0·15	8·19
1893	0·04	0·06	0·48	0·89	0·81	0·57	0·60	0·28	1·71	......	1·19	1·30	......
1894	0·42	0·05	T	0·31	1·12	......	0·27	0·00	0·54	0·76	2·13	......	......
1895	0·14	0·00	0·60	0·44	1·31	0·46	0·11	0·00	0·76	T	0·13	0·03	3·98
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1912	......	......	......	1·15	0·76	0·93	1·72	1·01	0·70	0·47	0·58	0·62	......
1913	0·98	0·27	0·13	0·53	1·60	2·23	0·20	1·28	0·26	1·50	1·08	0·40	10·46
1914	2·20	0·66	0·72	1·05	0·50	1·31	0·49	0·20	1·31	0·73	1·21	0·65	11·03
1915	0·40	0·32	0·44	0·18	3·07	0·82	......	......	......	......	......	......	......
Means	0·55	0·28	0·50	0·62	1·14	1·23	0·64	0·51	0·72	0·68	1·25	0·46	8·58

During 1891-1915 (1896-1911 no record), average monthly snowfall was: Jan., 3·9 in.; Feb., 1·8; Mar, 0·7; Oct., 1·1; Nov., 3·9; Dec., 2·5. Mean annual snowfall, 13·9 in.; maximum recorded, 17·8 in., Nov., 1894.

KEREMEOS (PROVINCIAL STATION)—Elevation, 1,361 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	0·06	1·55	0·16	1·14	0·54	0·00	......
1914	2·61	1·99	0·66	0·72	0·15	2·33	0·51	0·22	1·64	0·04	0·79	0·44	12·10
1915	0·40	0·29	0·32	0·10	3·14	0·53	2·13	0·95	0·42	0·17	0·72	2·58	11·75

Snowfall in Nov., 1913, 0·1 in. In Jan., 1914, 10·0; Nov., 1·0; Dec., 1·0; total in 1914, 12·0. In Jan, 1915, 4·0; Nov., 2·0; Dec., 9·0; total in 1915, 15·0 in.

KINGSGATE—Elevation, 2,600 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	4·61	0·77	......
1914	5·80	1·72	2·[illegible]	2·56	2·94	2·16	1·57	0·76	2·00	2·60	3·06	0·91	28·40
1915	1·25	1·84	1·16	2·14	3·06	2·88	3·57	0·45	3·20	1·84	4·09	3·21	28·69

Snowfall in Nov., 1913, 11 8 in.; Dec., 7·3. In Jan., 1914, 42·3; Feb., 11·1; Mar., 15·4; Nov., 7·5; Dec., 7·7; total in 1914, 84·0. In Feb., 1915, 11·9; Feb., 10·9; April, 2·3; Nov., 35·3; Dec., 23·0; total in 1915, 83·4 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

KITIMAT—Elevation, near sea-level

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1902	......	......	......	......	......	......	......	......	......	6·15	14·37	13·19	......
1903	4·93	4·94	......	......	......	4·51	2·30	3·40	7·98	24·54	10·00	10·65	......
1904	15·84	3·70	1·43	2·19	6·34	2·36	1·82	1·13	10·17	15·17	15·35	6·39	81·89
1905	2·00	2·80	4·37	3·78	2·12	0·63	1·47	9·46	11·18	7·90	13·70	14·80	74·21
1906	17·97	3·05	4·36	5·56	1·54	2·93	1·02	7·86	11·42	18·10	10·00	9·87	93·68
1907	5·10	11·38	4·48	4·03	1·00	1·05	1·55	3·22	3·38	......	......	......	......
	......	......	......	......	......	......	......	......	......	......	......	......	......
1910	......	......	8·81	......	......	......	......	......	......	......	......	......	......
Means	9·17	5·17	4·69	3·89	2·75	2·30	1·63	5·01	8·83	14·37	12·68	10·98	81·47

During 1902-07 (1904 and 1906, complete), average monthly snowfall was: Jan., 51·9 in.; Feb., 20·5; Mar., 12.8; Nov., 18·0; Dec., 41·5. Mean annual snowfall, 144·7 in.; maximum recorded, 100·1 in.; Dec., 1902.

KLINAKLINI—Elevation, about 3,000 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	......	0·19	0·02	1·30	1·05	3·90	1·86	......
1915	0·80	0·80	0·48	0·30	2·55	1·03	2·68	0·92	0·43	1·47	0·80	0·88	13·14

Snowfall in Nov., 1914, 13·9 in.; Dec., 18·6 in.; Jan., 1915, 8·0; Feb., 8·0; Mar., 0·5; April, 1·6; May, 0·4; Oct., 1·7; Nov., 8·0; Dec., 8·8, total in 1915, 37·0 in.

KNOUFF—Elevation, 3,000 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	......	......	......	......	......	......	......	0·85	1·68	1·00	0·53	1·68	......

Snowfall in Nov., 1915, 5·1 in.; Dec., 16·7 in.

KUPER ISLAND—Elevation, 20 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1894	......	......	......	......	......	......	......	2·96	4·96	5·69	4·18	4·21	......
1895	8·88	3·07	3·60	1·98	1·78	0·59	0·54	T	1·56	0·27	3·12	12·03	37·42
1896	11·97	4·90	3·28	1·68	1·64	0·88	0·27	0·17	1·23	2·56	8·97	8·41	45·96
1897	6·24	3·16	4·19	1·77	0·87	1·45	2·17	0·72	1·43	2·03	8·93	12·41	45·37
1898	2·61	6·84	0·97	1·40	1·39	3·04	0·30	0·22	1·76	4·23	6·25	4·11	33·12
1899	7·33	4·12	3·17	......	......	......	......	......	0·72	5·00	13·82	6·70	......
1900	6·49	4·71	8·62	1·60	2·55	2·39	0·71	1·07	1·48	4·25	5·50	8·24	47·61
1901	6·77	4·78	1·18	2·46	2·67	2·45	0·45	0·16	1·92	2·35	9·76	5·87	40·82
1902	5·56	10·54	3·11	1·82	2·12	1·24	0·84	0·46	1·27	2·96	8·62	10·61	49·15
1903	4·48	2·12	4·32	1·64	0·99	2·94	1·04	0·85	3·44	3·90	8·64	3·35	37·91
1904	8·16	5·56	5·48	1·73	1·29	0·76	0·92	0·98	0·44	1·91	10·36	10·00	47·59
Means	6·85	4·98	3·79	1·79	1·70	1·75	0·80	0·76	1·84	3·20	8·01	7·83	43·30

During 1895-1904 (1899 incomplete), average monthly snowfall was: Jan., 13·4 in.; Feb., 4·1; Mar., 5·9; Nov., 5·5; Dec., 4·1. Mean annual snowfall, 33·0 in.; maximum recorded, 34·2 in., Jan., 1896.

LADNER—Elevation, near sea-level

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	......	2·07	3·42	0·84	1·33	0·24	0·82	0·25	3·17	4·39	5·30	3·25	......
1879	......	7·83	7·29	1·90	2·87	0·78	3·84	1·84	1·24	5·60	3·42	4·21	......
1880	6·63	2·70	1·95	1·98	2·58	1·33	1·86	0·62	1·36	3·30	1·57	11·08	36·96
1881	5·81	6·52	3·83	3·07	3·12	2·85	1·00	0·82	1·55	5·11	3·60	6·26	43·53
1882	3·01	3·41	2·34	2·61	1·07	1·61	3·41	1·59	1·12	4·97	5·01	0·22	30·37
	......	......	......	......	......	......	......	......	......	......	......	......	......
1898	3·16	3·75	1·05	1·73	1·65	3·08	0·47	0·14	1·99	3·24	6·51	2·94	29·71
1899	6·14	4·17	2·32	2·69	4·02	0·36	0·35	4·53	1·00	......	12·32	5·30	......
1900	3·75	3·90	6·58	3·15	2·84	3·15	0·00	1·78	......	......	......	......	......
1901	2·77	5·53	1·25	2·71	2·55	2·78	......	......	......	......	......	......	......
1902	3·76	5·08	3·12	1·56	1·88	0·92	0·95	0·52	2·70	3·25	6·55	4·90	35·19
1903	5·05	1·49	2·30	1·76	1·84	2·21	1·11	0·86	6·06	4·86	8·38	4·65	40·58
1904	6·25	6·30	5·90	1·90	0·80	1·65	1·71	1·20	......	......	5·25	5·48	......
1905	4·37	2·16	4·10	0·40	2·20	1·64	0·75	1·82	8·81	3·40	2·68	5·37	37·70
1906	6·85	4·90	1·80	0·51	3·07	1·20	0·25	0·40	6·93	4·37	6·79	3·37	40·44
1907	4·75	4·15	1·52	2·72	0·55	1·32	0·61	1·15	3·60	1·21	6·51	7·15	35·24
1908	5·47	6·20	4·35	1·45	3·86	0·45	0·67	0·85	0·44	4·54	5·76	5·55	39·59
1909	2·90	5·71	3·00	0·42	2·30	1·60	1·72	0·42	1·95	4·68	8·31	1·76	34·77
1910	3·50	2·31	2·15	2·07	2·16	1·66	0·02	0·25	1·07	6·60	7·60	5·15	34·54
1911	2·99	2·21	1·95	1·05	5·65	1·10	0·90	0·60	3·00	2·70	7·91	8·88	38·94
1912	4·70	3·80	0·30	1·85	0·95	2·05	1·95	3·16	1·85	4·13	5·46	4·80	35·02
1913	2·27	1·80	2·70	1·58	3·30	2·57	1·65	0·25	1·90	3·40	8·25	2·15	31·82
1914	5·45	2·60	1·90	1·65	0·45	1·90	0·35	0·20	2·65	2·60	6·35	0·95	27·05
1915	2·90	1·85	1·90	1·25	1·65	0·45	0·65	0·07	0·50	4·34	5·58	5·30	26·44
Means	4·55	3·93	2·82	1·78	2·29	1·60	1·14	1·06	2·64	4·04	6·15	4·70	36·70

During 1879-1915 (16 years complete), average monthly snowfall was: Jan., 7·2 in.; Feb., 4·4; Mar., 1·5; Nov., 1·5; Dec., 3·6. Mean annual snowfall, 18·2 in.; maximum recorded, 24·0 in., Feb, 1879.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

LADYSMITH—Elevation, 68 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1913	......	......	......	......	0·60	1·84	0·77	0·83	2·86	3·98	12·12	2·69
1914	17·34	4·40	2·55	3·85	0·31	2·11	0·38	0·07	4·43	10·26	10·71	1·69
1915	5·67	3·31	4·91	1·83	3·12	1·09	0·54	0·21	0·28	7·92	7·57	12·15

Snowfall in Jan., 1914, 21·5 in.; Feb., 0·0; Mar., 3·0; Nov., 1·5; Dec., 1·2; total in 1914, 27·2. Total sn in 1915, 2·5 in., all in Dec.

LANGLEY—Elevation, 22 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1878	3·50	6·12	4·82	1·52	2·37	0·44	1·33	0·47	4·37	4·87	6·53	1·90
1879	10·60	11·21	10·60	2·57	2·30	2·25	4·13	2·41	......	10·92	7·78	8·72
1880	7·49	3·62	2·09	0·86	2·17	0·80	1·75	0·51	1·51	3·29	1·61	7·19
1881	3·16	6·45	2·66	3·64	4·23	5·66	4·70	1·93	1·58	5·23	6·16	7·53
1882	4·96	6·05	7·36	4·31	1·84	2·00	4·67	2·07	2·27	7·48	4·85	8·60
1883	7·64	4·50	3·72	4·23	1·25	1·62	0·18	0·50	3·49	4·59	14·43	6·50
1884	7·65	4·00	1·97	2·51	1·71	3·48	1·03	6·05	5·36	7·48	2·44	2·24
1885	11·72	9·03	2·05	0·38	3·99	1·05	0·32	0·03	6·16	3·19	8·18	......
1886	6·89	5·36	6·30	2·48	2·38	1·51	2·17	1·87	3·57	6·47	5·57	10·04
1887	8·12	7·44	11·84	5·25	3·19	1·39	0·05	0·31	2·53	0·99	8·34	9·25
1888	4·09	2·42	6·00	2·72	0·63	4·38	1·62	0·91	2·04	8·43	6·17	7·83
1889	5·40	3·77	5·40	2·47	2·62	2·46	0·00	2·81	4·81	4·69	3·86	6·03
......	......	......	......	......	......	......	......	......	......	......	......	......
1894	......	......	......	......	5·05	5·68	0·90	T	7·53	8·11	8·75	5·88
1895	6·57	6·83	4·66	3·83	4·91	3·07	0·71	0·52	5·41	0·99	6·31	7·96
1896	10·56	9·34	2·61	5·35	4·32	3·26	0·00	1·86	1·38	4·11	11·00	12·06
1897	8·34	5·99	6·10	3·68	5·29	2·56	3·52	0·81	3·40	2·50	9·42	10·21
1898	5·36	10·77	3·82	2·97	3·06	4·21	1·25	0·50	3·80	4·74	8·46	5·30
1899	9·91	5·89	2·94	4·33	4·63	2·14	0·92	4·56	1·48	5·78	14·50	10·77
1900	6·83	5·10	8·89	4·08	4·98	7·86	1·65	2·82	2·15	2·74	......	......
Means	7·16	6·33	5·21	3·18	3·21	2·94	1·63	1·63	3·49	5·08	7·47	7·53

During 1879-1900 (1890-94 no record), average monthly snowfall was: Jan., 9·7 in.; Feb., 6·9; Mar. Nov., 2·1; Dec., 6·1. Mean annual snowfall, 28·4 in.; maximum recorded, 26·5 in., Jan., 1880.

LAZO (LITTLE RIVER)—Elevation, 12 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1914	......	......	......	3·26	0·23	2·38	0·32	0·62	6·23	9·43	8·69	6·69
1915	5·70	5·46	3·08	2·45	1·17	0·22	0·80	0·22	1·02	9·17	6·11	9·10

Snowfall in Nov., 1914, 0·8 in.; Dec., 6·6. Total in 1915, 4·8 in., all in Dec.

LAZY 'L' RANCH (7 m. S. OF MAMIT LAKE)

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1913	......	......	......	......	......	......	......	......	......	1·28	2·22	0·95
1914	3·18	1·66	1·04	0·76	2·74	1·37	0·10	0·16	2·02	1·13	1·87	1·10
1915	1·95	0·54	1·41	1·24	3·16	2·56	1·52	0·41	0·65	0·11	1·04	1·66

Snowfall in Oct., 1913, 9·5 in.; Nov., 14·5; Dec., 9·5. In Jan., 1914, 28·2; Feb., 16·6; Mar., 10·0; 4·0; May, 4·0; Nov., 17·8; Dec., 11·0; total in 1914, 91·6. In Jan., 1915, 19·5; Feb., 5·4; Mar., 4·1; 7·7; May, 0·5; Oct., 0·5; Nov., 10·4; Dec., 16·6; total in 1915, 64·7 in.

LILLOOET—Elevation, 840 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1878	0·60	0·49	0·45	0·17	2·08	0·30	1·52	0·17	0·37	0·90	2·48	1·00
1879	3·00	1·63	4·27	0·75	2·29	2·31	2·24	0·30	1·10	1·03	0·83	2·32
1880	1·77	1·10	1·31	0·47	1·06	0·50	0·79	1·70	1·13	0·71	0·57	2·68
1881	1·46	1·62	0·35	0·90	2·47	1·12	1·47	1·52	2·11	0·58	0·75	2·95
1882	2·70	0·95	0·20	0·53	0·18	0·80	0·42	1·22	0·89	1·02	0·93	1·66
1883	2·27	0·30	T	0·64	0·68	2·90	0·14	0·10	0·69	1·54	3·85	......
Means	1·97	1·02	1·10	0·58	1·46	1·32	1·10	0·84	1·05	0·96	1·57	2·00

During 1878-83 (1883 incomplete), average monthly snowfall was: Jan., 9·4 in.; Feb., 6·4; Mar., 3·0; 0·2; Nov., 3·8; Dec., 7·2. Mean annual snowfall, 30·0 in.; maximum recorded, 17·2 in., Dec., 1879.

LOUIS CREEK (BARRIERE VALLEY)—Elevation, 1,230 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1912	......	......	......	......	1·28	1·31	3·32	2·64	1·72	......	......	......

LUMBY

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1912	......	......	......	......	......	......	......	......	......	1·36	1·50	1·75
1913	3·11	1·05	0·53	0·69	1·63	3·48	1·71	1·11	1·30	1·82	1·46	0·45
1914	2·45	1·69	0·67	0·75	0·91	2·33	1·00	0·00	1·41	1·20	1·26	0·68
1915	0·98	0·36	1·49	1·29	3·47	*	......	......	......	......	......	......
Means	2·18	1·03	0·90	0·91	2·00	2·91	1·36	0·56	1·36	1·46	1·41	0·96

*Observer went to the war, record suspended.

Snowfall in Jan., 1914, 24·5 in.; Feb., 16·9; Mar., 6·7; Nov., 12·6; Dec., 6·8; total in 1914, 67·3. In 1915, 9·8; Feb., 1·3 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

154 LYNCH CREEK—Elevation, 1,900 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	1·34	1·74	2·14	2·93	1·32	......
1914	4·62	1·30	1·63	2·20	1·48	1·07	0·35	0·05	2·92	1·73	2·20	1·40	20·97
1915	1·53	1·08	1·76	2·45	4·29	2·12	2·68	0·06	0·60	1·89	2·53	1·57	22·58

Snowfall in Oct., 1913, 13·5 in.; Nov., 12·3; Dec., 13·2. In Jan., 1914, 28·0; Feb., 10·0; Mar., 5·5; Nov., 4·0, Dec., 14·0; total in 1914, 61·5. In Jan., 1915, 15·5; Feb., 6·7; Nov, 22·6; Dec, 15·7; total in 1915, 60·5 in.

155 LYNN CREEK (N. VANCOUVER)—Elevation, 637 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	1·86	2·86	0·53	5·30	7·44	15·81	11·78	......
1914	20·46	6·90	10·37	4·95	2·88	4·96	0·00	1·66	11·21	2·34	11·42	3·16	80·21
1915	5·66	4·70	6·47	6·25	5·91	2·11	2·37	0·00	3·29	10·79	14·37	12·06	73·98

Snowfall in Jan., 1914, 15·0 in.; Feb., 5·0; Mar., 5·0; June, 2·0 (hail); Nov., 2·1; total in 1914, 29·1. Total snowfall in 1915, 9·6 in., all in Dec.

156 MALAKWA—Elevation, 1,215 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	1·20	2·02	1·39	0·43	2·79	1·77	4·83	1·15	......
1915	2·31	0·91	1·06	2·12	3·51	4·40	3·99	1·10	2·62	3·57	2·63	4·98	33·20

Snowfall in Nov., 1914, 1·0 in.; Dec., 11·5. In Jan., 1915, 23·1; Feb., 9·1; Nov., 19·5; Dec., 37·5; total in 1915, 89·2 in.

157 MAMIT LAKE—Elevation, 3,300 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	1·46	0·40	......	2·10	0·53	1·21	0·37	......
1915	1·55	0·65	1·45	0·79	3·15	2·81	1·59	0·23	0·97	0·65	1·03	1·21	16·10

Snowfall in Nov., 1914, 5·0 in.; Dec., 3·7. In Jan., 1915, 15·5; Feb., 6·5; Mar, 0·5; Nov., 10·5; Dec., 7·5; total in 1915, 40·5 in.

158 MARY ISLAND—Elevation, 25 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	3·05	0·71	2·79	0·31	1·57	6·33	7·90	11·73	4·60	......
1915	4·82	5·37	3·57	3·44	2·70	0·34	0·96	0·43	0·74	9·39	4·94	11·68	48·38

159 MASSET—Elevation, 30 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1897	......	......	......	......	......	2·20	2·37	3·37	2·31	3·62	0·68	3·04	......
1898	14·95	13·90	2·86	13·40	15·75	5·40	4·30	0·30	......	......	8·85	11·55	......
1899	15·48	5·53	3·35	13·35	......	......	......	0·70	3·05	6·80	8·05	5·42	......
1900	3·40	2·00	2·10	2·80	7·70	3·15	5·25	3·25	0·80	5·00	6·28	4·60	46·33
1901	2·55	2·75	5·40	4·45	3·65	1·35	4·30	2·75	2·60	......	......	......	......
1902	3·33	5·71	4·44	2·07	1·60	0·65	6·50	2·80	1·17	2·35	1·35	4·00	35·99
1903	8·20	3·50	2·15	8·80	16·35	6·40	0·35	2·65	2·75	10·15	11·65	9·51	82·46
1904	6·50	2·85	0·00	3·00	2·30	0·37	5·35	1·35	6·75	......	......	......	......
1905	1·70	2·15	4·82	2·05	6·53	0·00	0·65	8·35	10·65	6·40	5·60	7·50	56·40
1906	8·05	0·80	2·05	3·25	0·90	3·16	0·65	3·60	4·83	3·70	6·72	1·60	39·33
1907	0·40	3·05	3·75	3·75	2·00	0·85	1·70	3·38	0·39	4·08	9·02	6·52	39·49
1908	5·82	3·40	3·57	4·56	3·16	2·59	2·46	0·94	5·06	6·50	2·35	3·59	41·00
1909	3·55	3·30	2·72	1·24	0·86	2·42	4·81	5·49	6·88	5·45	3·27	3·37	43·36
1910	3·79	4·35	......	5·27	2·91	2·47	1·86	2·57	2·67	7·73	5·47	7·17	......
1911	5·20	3·37	4·70	3·78	1·13	3·42	2·44	0·41	3·64	3·37	4·76	5·78	42·00
1912	5·17	2·89	0·20	1·63	1·83	1·92	0·30	1·96	3·91	6·48	4·59	5·22	36·10
1913	5·10	2·35	4·59	4·81	3·10	2·51	2·26	2·13	6·52	8·59	12·06	9·36	63·38
1914	6·81	2·15	1·15	4·07	1·52	0·83	6·07	2·53	5·60	6·86	7·60	3·54	48·73
1915	7·41	4·69	5·06	6·39	1·18	2·80	2·26	3·75	5·28	14·48	9·16	10·25	72·71
Means	5·97	3·82	3·12	4·93	4·26	2·36	2·99	2·78	4·16	6·34	6·32	6·00	53·05

During 1898-1915 (3 years incomplete), average monthly snowfall was: Jan., 15·2 in.; Feb., 59·; Mar., 4·1; April, 2·0, Oct., 0·1; Nov., 3·2; Dec., 7·4. Mean annual snowfall, 37·9 in.; maximum recorded, 53·0 in., Jan., 1906.

160 METCHOSIN—Elevation, 80 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	......	......	......	......	......	......	......	0·01	0·42	5·55	6·78	7·41	......

Snowfall in Dec., 1915, 0·5 in.

161 McCLURE LAKE (TELKWA)—Elevation, 1,670 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	......	......	......	1·19	1·16	......
1914	1·80	2·79	1·02	0·65	0·31	1·29	1·68	0·21	1·78	2·20	3·27	0·95	17·95
1915	0·65	1·12	3·10	4·00	2·38	2·23	2·46	0·82	1·33	3·51	1·10	1·00	23·70

Snowfall in Nov., 1913, 8·7 in.; Dec., 9·0. In Jan., 1914, 18·0; Feb., 26·5; Mar., 10·2; April, 1·0; Nov. 5·7; Dec., 9·5; total in 1914, 70·9 in. In Jan., 1915, 6·5; Feb., 11·2; Mar., 3·0; Oct., 11·5; Nov., 11·0; Dec., 10·0; total in 1915, 53·2 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

McCOY LAKE (ALBERNI)

162 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1896	....	....	....	....	....	....	....	0·93	0·60	5·56	14·99	23·60	..
1897	11·99	7·63	7·30	4·80	1·69	2·55	2·31	1·83	2·15	3·74	9·97	16·91	72·
1898	4·38	16·74	....	....	....	....	....	....	....	....	....	....	....

Snowfall in Nov., 1896, 18·5 in. In Jan., 1897, 9·0, Feb., 3·0, Mar., 7·9; Nov., 11·5; Dec., 1·0; tot
1897, 32·4 in. In Jan., 1898, 4·0; Feb., 17·0 in.

MIDWAY—Elevation, 1,914 ft

163 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1895	....	....	....	....	....	....	....	0·05	2·35	0·33	0·68	0·84	....
1896	0·65	0·34	0·11	1·18	3·06	0·62	0·00	0·32	1·05	0·42	1·00	1·60	10·
1897	0·40	0·70	0·60	1·04	0·73	1·55	1·83	0·70	0·79	0·70	1·33	0·80	11·
1898	0·90	0·58	2·88	2·10	3·77	1·40	0·92	0·64	0·58	0·40	1·25	1·25	16·
1899	2·38	1·12	0·36	0·54	1·63	1·51	1·34	3·34	1·41	1·07	2·20	1·33	18·
1900	0·55	0·28	0·51	0·82	1·96	0·81	0·46	1·09	1·52	1·82	1·86	1·48	13·
1901	0·88	0·37	0·73	0·60	2·71	1·95	0·15	0·41	1·44	0·00	0·55	0·30	10·
1902	0·49	1·48	0·62	0·55	1·82	0·63	1·19	0·00	0·66	0·00	0·46	1·83	9·
1903	0·50	0·10	0·75	....	....	....	....	....	....	....	....	....	....
1904	0·82	0·50	0·00	....	....	....	....	....	....	....	....	....	....
Means	0·84	0·61	0·73	0·98	2·24	1·21	0·84	0·82	1·22	0·59	1·17	1·18	12·

During 1895-1904 (1896-1902 complete), average monthly snowfall was: Jan., 7·6 in.; Feb., 4·9; Mar., 1
Nov., 6·0; Dec., 9·9. Mean annual snowfall, 30·2 in.; maximum recorded, 23·8 in., Jan., 1899.

MILL BAY (NASS)—Elevation, 30 ft.

164 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1913	....	....	....	....	....	....	....	....	9·99	18·40	10·20	14·04	..
1914	3·66	6·55	6·13	4·67	3·67	1·40	10·24	4·20	8·88	5·89	10·36	3·14	68·
1915	6·53	4·96	2·03	7·56	2·15	3·26	2·52	2·59	6·16	16·98	9·43	9·70	73·

Snowfall in Nov., 1913, 28·2 in., Dec., 14·7. In Jan., 1914, 17·5; Feb., 15·5; Mar., 3·5; Nov., 7·5; D
21·5; total in 1914, 65·5. In Jan., 1915, 15·0; Feb., 40·5; Nov., 16·0; Dec., 36·0; total in 1915, 107·5

MONTE CREEK (DUCKS)—Elevation, 1,156 ft.

165 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1908	....	....	....	....	2·81	....	0·42	2·47	0·39	0·34	0·36	0·54	....
1909	0·61	0·76	0·21	0·10	0·28	1·08	2·34	0·38	1·24	0·75	0·65	0·16	8·
1910	0·17	0·42	0·25	0·70	0·63	2·07	0·42	1·71	0·28	1·78	0·74	1·70	10·
1911	0·43	0·15	0·28	0·35	0·15	....	0·52	1·06	1·29	0·03	1·94	1·84	....
1912	1·45	0·15	0·00	1·44	0·27	0·74	1·97	1·30	1·11	0·83	1·11	0·55	10·
1913	1·23	0·60	0·02	0·17	0·68	2·85	2·23	1·06	0·18	1·42	0·81	0·02	11·
1914	0·84	2·08	T	0·15	0·60	1·09	0·98	0·38	1·20	0·76	1·00	0·78	9·
1915	1·75	....	1·32	0·28	1·64	3·54	0·79	0·98	0·41	0·38	0·17	0·88	....
Means	0·93	0·69	0·30	0·46	0·88	1·90	1·21	1·17	0·76	0·79	0·85	0·81	10·

During 1908-15 (1909-14 complete), average monthly snowfall was: Jan., 7·9 in.; Feb., 6·1; Mar., 0·3; A
0·1; Nov., 3·2; Dec., 7·3. Mean annual snowfall, 24·9 in.; maximum recorded, 17·5 in., Dec., 1911.

MOHA (NORTH FORK BRIDGE RIVER)

166 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1913	....	....	....	....	....	....	....	....	....	0·67	2·95	0·11	..
1914	2·60	1·20	0·19	0·34	1·03	1·75	0·14	0·08	3·27	0·19	3·21	0·30	14·
1915	0·81	0·49	0·27	0·23	1·60	1·36	1·28	0·67	0·28	1·55	1·08	2·28	11·

Snowfall in Nov., 1913, 14·0 in.; Dec., 0·2. In Jan., 1914, 8·0; Feb., 12·0; Nov., 7·0; Dec., 3·0; tot
1914, 30·0. In Jan., 1915, 6·5; Feb., 0·2; Nov., 8·2; Dec., 17·0; total in 1915, 31·9 in.

NAKUSP—Elevation, 1,413 ft.

167 TOTAL PRECIPITATION

Year	Jan.	Feb	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Ann
1912	....	....	0·36	0·95	1·52	2·39	2·95	4·81	1·14	2·31	2·75	3·12	..
1913	4·81	1·86	2·01	0·55	1·68	2·53	1·55	2·35	2·89	1·97	3·36	1·18	26·
1914	5·24	1·54	0·96	3·07	1·65	2·43	1·57	0·93	2·90	1·98	3·31	1·58	27·
1915	2·00	1·62	1·02	3·85	4·57	3·70	3·11	0·63	1·05	2·84	2·01	3·53	29·
Means	4·02	1·67	1·09	2·10	2·35	2·76	2·29	2·18	2·00	2·27	2·86	2·35	27·

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 33·2 in.; Feb., 10·4; Mar., 3
Oct., 0·3; Nov., 10·3; Dec., 20·7. Mean annual snowfall, 79·9 in.; maximum recorded, 47·3 in., Jan., 1913

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

168 NANAIMO—Elevation, 125 ft.

Total Precipitation

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1892	1·67	1·48	2·2[illegible]	3·42	3·67	0·44	2·02	0·86	3·84	1·44	7·48	4·21	32·73
1893	2·71	6·58	5·06	3·54	3·11	2·96	0·49						
1894			...	...	...	...			...		...	...	......
							0·55	0·00	1·30	0·36	3·37	12·24	......
1896	14·38	6·82	1·46	1·39	1·96	1·30	0·00	0·53	0·79	2·85	8·41	9·48	49·35
1897	4·03	2·96	4·39	1·15	0·76	2·11	1·72	0·68	2·29	2·39	7·57	12·94	42·90
1898	2·92	7·34	1·78	1·97	2·12	2·74	0·31	0·0[illegible]	1·70	2·51	6·45	4·44	34·36
1899	7·53	4·68	2·61	1·72	2·04	0·91	0·74	1·77	1·17	5·91	10·33	6·80	52·25
1900	7·66	4·23	7·07	1·66	3·74	3·12	0·81	0·61	1·03	4·39	7·1[illegible]	11·41	52·80
1901	8·41	4·67	1·83	2·36	1·81	2·51	1·02	0·20	1·65	2·40	8·32	4·79	40·14
1902	5·34	[illegible]·08	3·74	1·24	2·15	1·30	0·80	0·75	1·26	2·10	7·82	8·83	46·41
1903	5·12	2·64	3·41	1·56	0·81	2·63	0·45	0·61	3·34	3·21	9·52	3·43	36·73
1904	8·78	10·61	6·38	1·68	0·91	0·94	0·96	1·39	0·40	2·31	11·18	10·66	56·20
1905	8·17	5·70	5·66	0·84	1·46	2·36	1·48	1·71	5·88	3·84	3·3[illegible]	5·47	45·46
1906	6·27	4·52	2·93	0·50	3·12	2·67	0·23	0·14	4·63	5·05	8·64	7·21	45·94
1907	4·52	4·92	2·87	2·60	1·34	2·12	0·72	[illegible]	2·95	0·89	6·57	8·18	38·[illegible]5
1908	9·83	6·05	3·37	1·98	2·53	1·00	0·63	[illegible]	0·51	3·17	11·25	6·02	47·04
1909	7·48	5·65	1·0[illegible]	0·35	1·97	0·65	0·93	[illegible]	1·02	2·96	11·90	4·07	39·62
1910	6·24	2·45	1·04	1·05	0·83	2·56	0·24	[illegible]·85	1·25	4·95	8·45	6·74	35·65
1911	7·53	1·69	0·64	1·12	3·08	0·93	0·04			1·11	5·74	3·15	......
1912										2·50	8·71	5·89	......
1913	5·58	1·77	1·19			2·11	1·31	0·[illegible]1	2·18	3·34	7·90	2·27	......
1914	10·80	2·59	2·54	2·60	0·16	1·70	0·10	0·33	4·03	6·13	7·62	2·16	40·85
1915	3·85	3·27	2·98	2·18	2·84	0·44	0·81	0·15	0·38	5·61	5·87	8·47	36·85
Means	6·34	4·84	3·10	1·74	2·02	1·79	0·71	0·66	2·05	3·12	8·16	6·76	41·32

During 1892-1915 (19 years complete), average monthly snowfall was: Jan., 12·7 in ; Feb., [illegible]3 ; Mar., 2·2 ; Nov., 3·1 ; Dec., 2·2. Mean annual snowfall, 26·5 in.; maximum recorded, 48·6 in. [illegible] 189[illegible].

169 NANAIMO*—Elevation, near sea-level

Total Precipitation

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1901			1·19	2·40	1·62	2·68	0·32	0·23	[illegible]	[illegible]	7·08	4·70	
1902	5·90	8·96	3·57	1·34	1·89	1·14	1·12	0·89	1·09	[illegible]	7·02	8·36	43·21
1903	4·43	2·16	2·75	1·79	0·70	2·63	0·96	0·70	[illegible]·58	[illegible]	9·78	3·36	36·61
1904	7·43	8·59	6·64	1·83	0·93	0·98	1·16	1·5[illegible]	0·47	2·2[illegible]	10·[illegible]	9·39	51·44
1905	5·57	5·22	6·09	1·02	1·53	2·06	1·92	1·60	5·58	1·65	3·81	4·78	42·81
1906	5·44	4·62	3·00	0·74	3·12	2·32	0·28	0·14	5·0[illegible]	5·29	8·61	5·94	44·53
1907	3·45	5·68	1·91	2·94	1·54	1·68	0·65	0·53	2·74	0·74	6·74	7·02	35·62
1908	9·40	6·70	3·07	2·02	2·36	0·54	0·64	0·66	0·10	3·34	11·39	6·02	46·24
1909	9·89	6·68	1·94	0·16	...	...	...	...	...	...	...	...	......
Means	6·44	6·08	3·35	1·58	1·71	1·75	0·88	0·77	2·53	2·93	8·10	6·20	42·32

During 1901-09 (1901 and 1909 incomplete), average monthly snowfall was Jan., 8·7 in ; Feb., 6·1 ; Mar., 1·8 ; Nov., 2·4 ; Dec., 1·5. Mean annual snowfall, 20·5 in ; maximum recorded, 25·7 in., Feb., 1904.

170 NANOOSE BAY—Elevation, 130 ft.

Total Precipitation

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1912					2·66	1·56		2·84	1·23	2·4[illegible]	7·17	4·58	
1913	2·18	1·27	1·32	1·96	1·13	2·56	1·34	1·16	2·85	3·70	7·78	2·20	29·45
1914	9·17	2·26	2·60	2·60	0·14	3·15	0·16	0·25	4·61	6·12	7·36	1·44	39·86
1915	2·91	3·89	1·66	1·32	2·37	0·78	0·55	0·25	0·47	4·85	5·49	4·06	28·60
Means	4·75	2·47	1·86	1·96	1·58	2·01	0·68	1·12	2·29	4·29	6·95	3·07	33·03

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 6·6 in ; Feb., 1·1 ; Mar., 1·9 ; Nov., 5·2 ; Dec., 0·7. Mean annual snowfall, 15·5 in ; maximum recorded, 15·7 in., Nov., 1914.

171 NARAMATA—Elevation, 1,150 ft.

Total Precipitation

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1913	.....	.....	.....	0·18	1·38	2·76	0·33	0·52	0·54	1·10	0·40	.....	
1914	.....	0·32	0·33	0·39	1·07	1·22	0·24	0·21	2·40	0·85	0·97	0·75	.....
1915	0·64	0·71	1·19	0·42	2·75	0·71	2·08	0·18	0·74	1·01	0·49	0·89	11·81

Snowfall in Feb., 1914, 3·2 in.; Dec., 5·0. In Jan., 1915, 3·2 ; Dec., 0·7 ; total in 1915, 3·9 in.

172 NASS HARBOUR—Elevation, 20 ft.

Total Precipitation

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1900	.....	8·15	5·70	7·24	5·07	5·83	2·68	3·88	3·86	12·33	10·63	3·84	....
1901	12·25	6·38	5·89	3·66	3·19	1·32	3·02	9·89	6·39	15·26	8·62	13·12	89·00
1902	8·45	1·70	4·64	2·69	1·98	2·55	2·66	11·58	10·07	6·39	7·99	12·46	73·16
1903	7·51	3·00	1·82	3·52	2·05	1·61	4·07	4·26	7·59	22·27	6·09	9·64	73·43
1904	10·01	0·93	2·58	4·41	5·29	4·35	3·20	1·24	15·00	10·62	12·29	9·82	79·74
1905	0·70	4·88	2·49	4·45	4·30	1·36	4·49	7·24	10·23	7·69	12·51	11·99	72·33
1906	19·40	......	2·17	6·23	2·08	4·69	2·86	10·34	......	8·35	9·25	6·39	......
1907	4·40	11·07	1·96	2·49	2·20	1·56	2·03	7·68	5·55	15·24	16·24	5·71	76·13

* This is a record kept by Mr. Good.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

NASS HARBOUR—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1908	6·92	2·40	8·34	11·41	4·06	1·89	3·00	2·22	24·88	18·95	7·33	5·91	97·3
1909	7·30	3·19	5·36	5·51	3·89	2·39	5·38	8·13	14·67	11·49	4·50	3·30	75·1
1910	7·69	8·78	9·76	7·83	1·25	3·51	2·50	3·60	8·11	13·67	6·23	17·32	90·2
1911	13·65	2·85	......	4·67	2·71	3·12	3·78	3·43	3·61	......	......	8·41	......
1912	3·58	5·40	1·07	1·30	5·46	5·89	1·32	0·33	7·70	11·70	12·58	11·75	68·0
1913	6·95	3·58	8·62	5·77	2·16	2·65	5·99	4·47	11·67	17·08	8·86	13·09	90·8
1914	5·18	6·46	5·59	5·36	3·53	1·09	9·79	3·03	8·84	5·86	10·25	2·18	67·1
1915	9·33	3 95	2·70	7·21	2·27	2·57	2·04	2·45	5·84	14·09	9·18	8·47	70·1
Means	8·22	4·85	4·58	5·23	3·22	2·90	3·66	5·24	9·60	12·72	9·51	8·96	78·6

During 1901-15 (1906 and 1911 incomplete), average monthly snowfall was : Jan., 44·5 in.; Feb., 17·1 ; Ma 12·2 ; April, 2 9 ; Nov., 7·0 ; Dec., 22·4. Mean annual snowfall, 106·1 in.; maximum recorded, 89·0 in., De 1902, and Jan., 1911.

NEEDLES (FAUQUIER)—Elevation, 1,430 ft.

173 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1909	......	......	......	......	......	......	3·43	......	......	......	......	0·18	......
1910	1·40	3·04	......	......	......	......	0·10	1·40	1·65	4·21	4·15	2·40	......
1911	2·90	1·95	0·60	1·85	3·40	2·70	0·90	1·40	1·30	0·10	3·60	2·90	23·6
1912	3·00	0·70	0·20	0·70	......	......	......	......	......	......	......	......	......
1913	......	0·27	0·77	1·09	2·34	3·65	1·40	2·60	2·16	2·14	1·80	0·40	......
1914	3·95	1·50	0·94	2·39	1·31	1·53	0·40	0·46	3·63	2·36	2·49	1·00	......
1915	1·25	1·50	0·88	3·09	4·13	2·79	2·91	0·48	0·94	2·15	......	......	......
Means	2·50	1·49	0·68	1·82	2·80	2·67	1·52	1·27	1·94	2·19	3·01	1·37	23·2

During 1909-15 (1911 complete), average monthly snowfall was : Jan., 20·5 in.; Feb., 13·3 ; Mar., 1·9 ; Nov 6·5 ; Dec., 10·9. Total snowfall in 1911, 91·5 in.; maximum recorded, 30·4 in., Feb., 1910.

NELSON—Elevation, 1,760 ft.

174 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1898	......	......	......	......	......	......	......	......	1·95	1·96	2·23	2·85	......
1899	2·47	1·66	0·66	1·43	2·62	3·03	2·40	3·63	1·78	2·88	......	......	......
1900	1·16	......	......	......	2·36	3·03	1·44	2·31	1·47	4·11	3·18	5·64	......
1901	[illegible]	1·45	1·16	1·60	2·70	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1904	3·46	7·03	5·79	1·23	0·55	2·67	1·29	0·90	0·48	1·53	2·93	2·45	30·3
1905	2·13	1·83	1·88	1·16	4·00	4·55	1·92	0·63	2·27	3·59	2·75	2·30	29·0
1906	3·88	2·60	1·02	1·10	1·88	2·76	0·25	0·56	1·25	2·42	4·36	3·57	25·6
1907	3·65	2·35	1·12	2·24	2·62	......	1·94	7·51	1·39	1·20	3·36	3·45	......
1908	3·39	3·94	2·47	2·11	2·41	1·90	1·45	0·79	0·98	2·32	1·80	0·53	24·0
1909	5·87	......	1·07	0·29	0·99	2·25	4·57	0·67	2·43	2·35	7·65	1·75	......
1910	1·30	1·75	1·18	1·67	1·61	2·22	0·10	0·26	1·35	1·87	1·46	1·48	16·2
1911	2·90	1·20	1·25	0·76	2·11	2·63	0·62	1·03	3·33	0·82	5·15	2·45	24·2
1912	3·58	1·74	0·58	1·38	2·31	2·26	5·60	2·57	1·19	2·80	3·25	3·15	30·4
1913	4·60	0·90	1·42	1·16	2·10	3·42	2·44	2·35	3·17	2·05	3·95	0·80	28·3
1914	6·10	1·00	1·58	3·07	1·95	2·56	1·05	0·24	3·44	1·85	4·03	0·70	27·5
1915	1·10	0·80	0·85	2·59	3·72	2·09	3·87	0·60	1·12	2·18	3·16	3·57	25·6
Means	3·39	2·17	1·57	1·56	2·26	2·72	2·07	1·72	1·84	2·26	3·52	2·48	27·5

During 1898-1915 (11 years complete), average monthly snowfall was : Jan., 24·7 in.; Feb., 16·7 ; Mar., 6· April, 1·2 ; Oct., 0·2 ; Nov., 10·6 ; Dec., 17·1. Mean annual snowfall, 77·3 in.; maximum recorded, 69·3 in Feb., 1904.

NEW DENVER—Elevation, 1,800 ft.

175 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1914	......	......	1·09	3·53	1·74	2·74	0·76	0·69	4·16	2·59	4·19	1·10	......
1915	2·00	1·96	0·72	2·77	3·90	3·74	3·36	1·14	1·52	2·78	2·44	2·95	29·2

Snowfall in Nov., 1914, 3·0 in.; Dec., 11·0. In Jan., 1915, 13·7 ; Feb., 6·7 ; Nov., 10·2 ; Dec., 19·7 ; tota in 1915, 50·3 in.

NEWGATE (GATEWAY—DOMINION STATION)—Elevation, 2,400 ft.

176 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1914	......	......	......	0·46	0·93	1·49	1·00	1·76	0·89	2·07	1·19	0·40	......
1915	0·40	0·83	0·36	1·81	2·13	2·15	3·18	0·68	1·94	0·46	1·64	1·50	17·0

Snowfall in Nov., 1914, 6·0 in.; Dec., 4·0. In Jan., 1915, 4·0 ; Feb., 7·0 ; Nov., 14·0 ; Dec., 15·0 ; total i 1915, 40·0 in.

NEWGATE (GATEWAY), YAKITE RANCH (PROVINCIAL STATION)—Elevation, 2,400 ft.

177 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu
1913	......	......	......	......	......	......	......	......	......	0·36	1·50	0·80	......
1914	3·70	0·52	1·54	1·32	0·78	0·97	0·64	1·30	0·99	1·99	2·26	0·65	17·66
1915	0·91	1·62	0·96	1·65	2·16	3·88	2·01	0·14	1·88	0·46	1·64	1·50	18·81

During 1913-15 (1913 incomplete), average monthly snowfall was : Jan., 14·6 in.; Feb., 2·4 ; Mar., 3·5 May, 2·3 ; Nov., 9·6 ; Dec., 9·8. Mean annual snowfall, 42·2 in.; maximum recorded, 20·0 in., Jan., 191

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

178 NEW HAZELTON—Elevation, 1,030 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914								0·28	2·25	1·73	3·82	1·17	....
1915	0·63	1·34	0·48	1·04	1·30	2·25	3·47	2·27	1·67	2·25	0·47	1·19	18·36

Snowfall in Nov., 1914, 21·9 in.; Dec., 11·7. In Jan., 1915, 5·3; Feb., 11·4; Mar., 1·0; Nov., 2·5; Dec., 6·8; total in 1915, 27·0 in.

179 NEW WESTMINSTER—Elevation, 330 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1874	13·95	9·62	6·09	3·46	3·70	2·31	0·93	2·24	0·37	2·51	11·61	7·63	64·42
1875	4·52	4·05	1·22	2·46	7·13	4·81	0·02	2·20	3·70	0·72	7·65	7·04	45·52
1876	4·14	9·11	8·02	4·95	2·89	2·35	1·58	2·27	0·08	8·80	10·61	17·06	71·86
1877	7·35	4·95	7·47	1·55	1·62	2·65	1·03	2·78	2·64	5·27	6·07	4·20	47·67
1878	4·82	6·72	6·79	1·33	2·17	0·65	1·24	0·53	6·15	4·65	9·96	5·81	50·82
1879	8·81	11·22	11·02	3·37	5·52	1·24	5·14	2·62	5·05	7·08	7·41	5·64	64·12
1880	5·46	1·43	1·45	2·95	4·39	2·27	2·53	1·11	2·04	8·44	4·23	7·39	43·69
1881	5·89	14·19	6·33	3·15	3·54	5·26	2·20	2·48	2·02	4·95	2·49	15·99	68·49
1882	5·46	7·76	7·12	6·05	2·02	2·33	4·08	1·93	2·09	6·16	6·36	11·23	62·59
1883	9·17	7·40	6·44	3·15	3·54	2·30	1·75	2·12	1·97	8·24	5·33	11·74	63·15
1884	8·02	3·70	1·63	2·11	3·05	3·28	0·77	7·01	2·34	5·53	16·71	6·62	60·77
1885	10·43	9·07	2·48	0·87	3·91	0·47	0·48	0·02	5·93	8·77	3·56	3·61	49·90
1886	7·58	4·77	4·61	3·28	2·33	1·54	2·40	1·60	7·53	3·14	11·56	5·83	56·19
1887	10·34	9·76	9·46	5·38	3·74	0·84	0·23	0·74	2·94	5·28	7·00	15·89	71·60
1888	9·01	6·31	6·88	3·78	1·40	5·46	1·47	0·45	1·78	8·94	7·18	10·79	63·45
1889	6·29	4·31	4·98	2·69	3·06	1·93	0·04	3·13	3·69	4·83	5·74	7·12	47·81
1890	......	......	......	......	......	3·90	2·42	2·53	......	......	4·20	9·78	......
1891	7·83	......	......	......	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......
1894	......	......	......	......	......	5·60	0·68	0·46	9·23	7·23	8·60	6·78	......
1895	7·01	4·90	3·06	3·66	4·43	0·83	0·46	0·00	0·00	0·91	5·97	5·68	36·91
1896	12·41	7·38	1·71	4·54	2·12	3·05	0·00	1·04	1·30	4·21	8·08	0·34	46·18
1897	6·68	5·04	4·71	4·37	1·74	3·50	3·56	0·84	2·78	2·16	10·81	10·78	56·97
1898	7·15	10·54	2·97	2·51	3·15	5·10	0·62	0·21	3·81	4·45	9·67	4·63	54·81
1899	7·56	7·41	6·44	4·31	5·02	2·33	0·79	4·53	1·46	6·92	14·66	11·28	72·71
1900	6·47	5·30	9·44	4·48	4·02	5·63	1·59	3·30	2·04	8·82	9·20	9·39	69·68
1901	8·97	8·62	3·71	5·07	3·79	5·52	1·41	0·20	2·76	4·33	11·98	7·09	63·45
1902	8·61	8·36	6·33	3·21	3·66	1·95	2·29	1·08	3·84	3·85	10·75	9·31	63·24
1903	7·08	1·69	4·31	3·75	3·26	2·90	2·31	1·38	9·10	5·39	12·42	4·98	58·57
1904	9·70	7·87	6·41	3·51	1·83	1·85	1·57	1·27	2·59	3·63	8·26	10·60	59·09
1905	6·41	4·21	7·08	1·36	2·44	3·16	0·93	1·61	10·36	5·78	4·52	5·51	53·37
1906	9·09	5·94	2·74	1·12	3·40	3·38	0·39	0·83	9·56	8·64	7·19	6·95	59·23
1907	7·15	8·32	2·62	4·04	0·86	2·09	1·21	3·25	4·37	1·70	12·49	8·20	55·30
1908	6·81	5·72	7·49	2·38	4·05	1·15	1·93	1·02	1·33	6·23	11·35	8·21	57·67
1909	5·95	7·88	4·69	1·33	3·92	1·56	2·49	2·56	1·93	6·46	14·61	5·68	59·06
1910	10·81	4·55	3·70	3·88	3·01	2·25	T	0·72	2·51	9·22	10·95	8·98	60·64
1911	5·45	3·21	3·31	2·35	5·33	2·18	0·66	1·22	4·21	1·90	11·57	9·28	50·67
1912	8·40	6·00	0·65	4·27	2·27	2·81	1·85	6·33	2·14	6·00	8·32	8·50	57·53
1913	8·84	5·39	6·28	3·12	5·03	4·84	1·68	0·76	3·09	6·34	9·56	4·17	59·10
1914	9·95	4·78	3·27	3·95	1·04	4·11	0·56	0·68	5·57	5·62	10·95	2·44	52·92
1915	6·98	4·04	4·22	3·47	3·12	0·61	0·92	0·16	1·46	10·29	6·09	10·90	52·28
Means	7·81	6·53	5·07	3·28	3·28	2·80	1·44	1·75	3·57	5·61	8·86	8·03	58·03

During 1911-15, average monthly snowfall was: Jan., 24·9 in.; Feb., 3·5; Mar., 2·0; Nov., 4·2; Dec., 5·4. Mean annual snowfall, 40·0 in.; maximum, 74·6 in., Jan., 1913
Snowfall at this station has not always been measured separately.

180 NICOLA-CLAPPERTON CREEK WATERSHED (MILL CREEK)—Elevation, 3,100 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	1·76	1·35	1·26	1·72	0·60	....
1914	2·71	0·60	0·85	0·53	1·46	0·67	0·45	0·17	2·15	1·48	2·26	0·94	13·97
1915	1·60	0·35	0·51	1·12	4·42	2·67	1·28	0·65	1·22	1·16	1·02	1·48	17·48

Snowfall in Dec., 1913, 6·0 in. In Jan., 1914, 22·0; Feb., 5·5; Mar., 8·5; April, 0·5; Nov., 10·0; Dec., 9·4; total in 1914, 55·9. In Jan., 1915, 16·0; Feb., 3·5; Mar., 3·0; April, 3·0; Nov., 7·5; Dec., 12·0; total in 1915, 45·0 in.

181 NICOLA LAKE—Elevation, 2,120 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1878	0·47	0·56	0·65	1·87	1·49	0·58	1·42	0·30	0·39	0·[illegible]1	0·73	0·98	9·75
1879	0·99	2·44	2·53	0·77	1·11	2·40	3·19	1·09	0·23	0·54	0·77	1·36	17·42
1880	2·31	0·53	0·85	0·24	0·29	0·09	0·47	0·74	0·69	0·21	0·26	2·33	9·01
1881	1·97	1·60	0·24	0·32	1·10	1·07	0·53	1·55	1·68	1·87	0·81	0·52	13·26
1882	0·67	0·63	0·17	0·26	0·60	1·97	0·86	1·12	0·70	1·27	1·05	0·57	9·87
1883	1·41	0·83	0·41	0·31	1·18	0·65	0·12	0·35	0·39	0·86	1·18	0·86	8·55
1884	0·91	0·56	0·11	0·77	0·28	1·30	1·85	0·94	1·75	0·64	0·10	0·77	9·98
1885	2·48	0·76	0·10	0·20	2·21	1·47	1·57	0·83	1·31	0·23	0·80	0·55	12·51
1886	2·33	0·61	0·37	0·57	0·49	0·52	0·32	0·67	0·24	0·80	0·26	2·05	9·23
1887	0·83	0·40	0·38	1·38	0·55	1·97	0·69	0·47	0·70	0·64	1·29	1·47	10·77
1888	2·24	0·34	1·23	0·65	2·30	2·38	0·55	0·44	0·15	1·91	0·71	1·39	14·29
1889	0·86	0·49	0·88	0·28	1·83	0·22	0·63	0·31	0·82	1·52	0·57	1·55	9·96
1890	1·40	0·85	0·84	0·19	1·53	2·26	0·98	1·66	0·37	1·33	0·67	1·44	13·52

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

NICOLA LAKE—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ann
1891	0·08	0·86	0·52	0·51	0·51	2·86	0·50	1·23	0·72	0·61	1·11	1·67	11·
1892	0·40	0·10	0·64	1·15	0·62	1·09	0·64	0·37	0·44	1·65	2·10	1·69	10·
1893	......	......	0·95	1·34	1·46	0·69	0·43	0·34	0·97	0·86	......	......	......
1894	1·13	0·35	0·10	0·09	1·05	1·84	0·30	0·11	0·76	1·18	0·92	0·25	8·
1895	1·16	0·24	0·40	0·28	2·84	0·27	0·87	0·40	1·16	0·19	0·18	1·33	9·
1896	1·82	0·87	0·52	0·80	1·56	0·20	0·00	0·10	1·00	0·28	0·76	0·97	8·
1897	0·47	1·09	0·57	0·80	0·49	3·08	1·74	0·24	0·49	0·94	2·19	1·17	12·
1898	0·25	0·42	0·92	0·10	1·53	1·25	0·39	0·12	0·70	1·82	1·67	0·38	9·
1899	0·81	0·70	0·55	0·38	1·02	1·48	1·80	3·46	1·10	0·96	0·41	0·83	13·
1900	0·29	0·62	0·46	0·51	0·09	2·27	1·22	3·26	1·27	1·62	1·60	0·55	14·
1901	0·80	0·59	0·39	0·43	0·65	2·45	1·02	0·03	1·12	0·22	0·98	0·37	9·
1902	0·70	1·11	0·94	0·68	1·83	1·24	1·11	0·26	0·94	0·16	2·46	1·93	13·
1903	0·32	0·15	1·41	0·16	0·16	1·41	3·18	2·75	2·57	0·66	1·13	0·21	14·
1904	0·67	2·12	1·78	1·61	0·00	0·90	0·34	0·14	0·57	0·10	1·22	1·43	10·
1905	0·88	0·24	0·35	0·58	1·87	0·99	1·30	0·24	2·14	1·03	0·20	0·42	10·
1906	0·80	0·35	0·05	0·00	2·37	1·36	0·30	0·12	0·77	0·80	1·51	2·28	10·
1907	0·22	0·67	1·37	0·00	0·53	1·00	1·07	2·52	2·30	0·06	0·88	1·20	12·
1908	0·64	0·96	0·23	0·03	1·11	0·24	0·30	1·54	0·26	0·53	0·31	1·22	7·
1909	1·96	1·18	0·05	0·41	1·08	0·81	1·45	0·19	0·84	0·11	1·77	0·48	10·
1910	0·35	1·40	1·10	0·14	1·21	1·71	0·28	0·92	1·46	0·56	1·44	0·70	11·
1911	1·55	0·38	0·10	0·35	0·93	0·46	0·28	1·53	1·17	0·33	2·48	1·32	10·
1912	1·24	0·82	0·08	1·50	0·83	0·88	1·58	2·03	0·97	1·12	1·20	0·53	12·
1913	0·78	1·46	0·15	0·15	0·77	2·02	0·85	1·49	0·73	0·90	1·28	0·24	10·
1914	1·82	0·45	T	0·25	3·95	0·45	0·04	0·05	......	......	0·85	0·60	......
1915	0·95	0·00	0·30	......	......	......	1·57	0·57	0·83	0·82	0·77	1·36	......
Means	1·07	0·75	0·60	0·54	1·19	1·29	0·95	0·90	0·94	0·77	1·04	1·05	11·

During 1878-1915 (1878-92 and 1894-1913 complete), average monthly snowfall was: Jan., 8·9 in.; Feb., 5· Mar., 2·8; April, 0·6; Oct., 0·4; Nov., 4·7; Dec, 7·7. Mean annual snowfall, 30·6 in.; maximum record 23·3 in., Jan., 1885.

NINTH CABIN

182

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ann
1914	......	......	......	......	......	......	......	......	......	......	5·17	1·88	......
1915	6·54	1·13	1·39	1·43	1·54	1·49	1·43	1·76	1·47	4·67	2·18	3·91	28·

Snowfall in Nov., 1914, 51·7 in.; Dec., 18·8. In Jan., 1915, 65·4; Feb., 11·3; Mar., 3·3; April, 4·7; M 2·5; Oct., 6·0; Nov., 21·8; Dec., 39·1; total in 1915, 154·1 in.

NITINAT LAKE—Elevation, near sea-level

183

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ann
1914	......	......	......	......	......	......	......	......	9·74	20·04	24·06	6·77	......
1915	9·62	12·70	10·09	10·75	6·25	0·70	2·68	1·95	1·58	23·08	18·62	44·41	142·

Snowfall in Dec., 1914, 0·7 in. Total in 1915, 3·0 in., all in Dec.

NORTH BEND—Elevation, 495 ft.

184

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ann
1915	......	......	......	......	1·76	0·47	1·42	0·34	0·63	5·33	6·37	9·53	..

Snowfall in Nov., 1915, 10·0 in.; Dec., 27·4 in.

NORTH NICOMEN (LOCH ERROCH)—Elevation, 59 ft.

185

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Ann
1893	5·90	6·69	7·78	7·8[illegible]	7·44	4·04	2·51	2·50	5·53	10·03	13·32	18·39	91·
1894	9·11	8·17	9·52	11·76	6·67	5·96	2·48	0·40	10·39	13·38	13·01	5·99	96·
1895	6·87	11·73	5·66	3·94	[illegible]	2·00	0·46	0·31	9·26	4·04	8·83	14·62	77·
1896	14·49	[illegible]	5·25	8·43	3·78	4·32	0·00	0·14	0·23	......	......	......	......
1897	2·32	5·62	6·73	4·33	3·61	9·73	4·71	0·87	3·50	4·88	14·67	13·57	74·
1898	8·82	13·03	4·72	4·82	2·40	4·59	2·64	0·56	4·79	6·83	11·08	7·39	71·
1899	9·98	8·13	4·44	5·20	5·60	4·24	2·51	5·92	1·94	6·29	16·93	11·23	81·
1900	9·07	6·35	7·62	4·85	6·93	10·67	2·11	5·14	3·88	8·76	5·38	10·60	81·
1901	8·26	9·34	5·55	8·43	4·87	6·11	0·82	0·05	2·70	6·50	14·60	7·01	74·
1902	7·66	11·41	7·67	5·03	3·69	2·54	3·55	1·57	0·60	4·75	12·62	11·15	72·
1903	11·49	2·44	5·78	4·43	4·57	3·74	2·61	2·86	10·51	7·40	15·63	9·68	[illegible]
1904	10·19	8·49	8·64	4·02	2·76	4·44	2·14	0·75	2·58	4·16	9·57	12·83	[illegible]
1905	7·28	5·47	6·41	2·07	5·59	2·78	0·55	4·48	10·67	9·86	4·71	6·97	66·
1906	9·83	6·56	1·71	2·15	4·37	4·77	0·51	0·58	8·92	13·70	9·78	8·76	71·
1907	1·67	11·51	4·21	6·23	1·74	2·09	2·12	2·55	2·61	2·80	13·29	8·45	59·
1908	7·84	5·96	10·85	5·66	3·11	1·62	1·16	2·33	0·81	6·57	9·41	8·06	63·
1909	10·07	10·26	4·03	1·47	4·94	1·24	3·20	2·33	3·69	8·63	22·05	5·88	77·
1910	11·89	6·90	7·55	5·55	4·42	2·89	0·23	2·78	1·72	14·63	16·42	11·26	86·
1911	8·17	3·74	5·10	2·97	5·22	1·55	1·61	2·41	7·21	1·79	15·49	9·13	64·
1912	10·10	6·65	1·10	3·19	2·06	2·93	2·82	3·06	1·33	6·94	13·19	8·50	61·
1913	8·80	7·19	6·91	3·88	3·57	4·25	3·52	2·75	8·50	10·51	13·29	3·56	[illegible]
1914	17·01	4·44	5·09	5·00	2·61	3·08	0·08	0·51	8·15	6·45	12·64	2·70	67·
1915	8·70	4·21	3·13	4·95	4·64	1·60	1·92	0·03	1·46	11·61	7·46	13·62	[illegible]
Means	8·93	7·84	5·88	4·97	4·56	3·92	1·93	1·95	4·82	7·75	12·42	9·52	[illegible]

During 1893-1915 (1896 incomplete), average monthly snowfall was: Jan., 13·3 in.; Feb., 8·7, Mar. Nov., 4·0; Dec., 6·4. Mean annual snowfall, 36·0 in.; maximum recorded, 51·5 in., Jan., 1912

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

186 NORTH THOMPSON (KAMLOOPS)—Elevation, 1,100 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	0·86	0·80	1·26	0·71	0·67	.....
1914	1·09	1·92	0·26	0·26	1·14	0·49	0·59	0·54	1·37	0·61	.....	.....	.....

Snowfall in Nov., 1913, 3·0 in.; Dec., 2·0. In Jan., 1914, 9·4; Feb., 19·2 in.

187 CONSERVATION BAY (SONORA ISLAND)—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	.....	.....	.....	6·32	4·82	0·12	1·80	1·28	0·82	15·83	9·24	15·89	.....

Snowfall in Dec., 1915, 10·5 in.

188 OCEAN FALLS—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	10·06	18·63	15·91	11·49	7·97	4·80	1·18	4·41	8·03	.....	13·98	24·79	.....

Snowfall in Feb., 1915, 8·6 in., Nov., 1·7; Dec., 12·5 in.

189 OYSTER BAY—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	6·51	7·47	11·63	.....

Snowfall in Dec., 1915, 2·0 in.

190 PARKSVILLE—Elevation, 200 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	6·35	4·51	7·26	.....

191 PEACHLAND (WINBORNE RANCH)—Elevation, 1,100 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	0·38	2·78	1·35	1·42	.....
1914	4·18	1·48	0·58	0·75	1·13	1·24	0·47	0·03	2·28	1·21	1·76	1·71	16·82
1915	1·75	0·90	1·73	1·03	2·48	1·21	2·17	0·52	2·01	1·89	2·66	1·60*	19·95

Snowfall in Dec., 1913, 14·2 in. In Jan., 1914, 20·8; Feb., 6·0; Nov., 9·0; Dec., 17·1; total in 1914, 52·9. In Jan., 1915, 10·1; Feb., 2·5; Nov., 18·0; Dec., 7·5* in.

* Figures for December, 1915, include from 1st to 14th only.

192 PEMBERTON HATCHERY—Elevation, about 700 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1908	.....	.....	.....	2·15	2·40	0·88	1·57	0·47	1·38	3·73	11·75	4·02	.....
1909	6·54	3·83	1·33	0·18	1·02	0·86	1·09	1·69	2·12	2·92	7·95	1·90	31·43
1910	4·87	2·88	1·81	1·67	1·87	1·02	0·23	1·43	1·89	8·30	6·13	3·86	35·96
1911	3·25	0·90	1·09	0·73	2·00	0·43	0·26	2·09	1·93	0·46	6·06	2·82	22·62
1912	3·63	1·59	0·20	1·10	1·05	1·63	1·17	3·25	1·39	3·36	5·49	4·08	27·94
1913	3·20	2·07	0·77	1·15	1·19	2·67	1·66	3·15	3·61	3·22	7·63	1·23	31·55
1914	5·85	1·51	2·81	2·46	1·58	1·57	0·34	0·15	5·41	4·35	8·44	0·98	35·45
1915	2·60	3·28	1·47	2·12	1·91	0·65	1·63	0·53	0·38	6·59	2·02	5·98	29·14
Means	4·28	2·29	1·35	1·45	1·63	1·21	0·99	1·60	2·26	4·12	7·01	3·11	31·30

During 1908-15 (1908 incomplete), average monthly snowfall was: Jan., 22·6 in.; Feb., 7·5; Mar., 0·6; Nov., 6·0; Dec., 10·5. Mean annual snowfall, 47·2 in.; maximum recorded, 63·5 in., Jan., 1909.

193 PEMBERTON MEADOWS—Elevation, 700 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	.....	.....	.....	.....	.....	.....	.....	.....	1·79	2·48	7·92	5·14	.....
1913	4·70	1·94	1·05	1·37	1·58	0·97	1·35	1·50	4·64	3·79	8·19	3·27	34·35
1914	10·78	2·28	3·03	2·34	0·76	1·35	0·28	0·08	4·63	5·46	9·23	1·65	41·87
1915	3·99	3·69	1·73	2·58	0·93	0·51	1·25	0·36	0·51	5·88	4·65	7·93	34·01
Means	6·49	2·64	1·94	2·10	1·09	0·94	0·96	0·65	2·89	4·65	7·50	4·50	36·35

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 46·2 in.; Feb., 12·8; Mar., 2·7; Nov., 22·1; Dec., 28·4. Mean annual snowfall, 112·2 in.; maximum recorded, 72·0 in., Jan., 1914.

194 PENTICTON—Elevation, 1,150 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	.....	.....	.....	0·19	.....	.....	0·37	1·13	0·78	0·30	0·21	0·94	.....
1908	0·96	0·76	0·62	0·28	0·79	0·48	0·75	3·04	0·88	0·76	0·42	.....	.....
1909	0·79	3·08	0·38	0·05	1·30	1·12	2·37	0·39	1·58	0·83	0·71	0·74	13·34
1910	0·63	0·51	0·12	0·45	1·66	1·33	0·49	0·94	0·52	0·62	0·41	.....	.....
1911	.....	.....	0·32	0·21	1·62	1·45	0·35	1·26	1·20	0·23	1·54	0·92	.....
1912	1·01	0·76	0·05	1·15	1·16	1·52	1·14	1·13	1·37	1·00	1·02	0·49	11·80
1913	0·64	0·42	0·28	0·44	2·21	3·82	0·54	1·17	0·38	1·48	0·63	0·65	12·56
1914	2·13	0·49	0·46	1·26	1·22	1·24	0·35	0·31	2·16	0·81	1·25	0·76	12·44
1915	0·65	0·44	1·08	0·91	3·49	1·46	2·33	0·27	1·01	0·99	0·77	1·14	14·56
Means	0·97	0·92	0·41	0·54	1·68	1·55	0·97	1·07	1·10	0·78	0·77	0·81	11·57

During 1907-15 (5 years complete), average monthly snowfall was: Jan., 6·5 in.; Feb., 3·0; Mar., 0·6; Nov., 1·6; Dec., 5·1. Mean annual snowfall, 16·8 in.; maximum recorded, 10·5 in., Jan., 1914.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

195 PENTICTON (CARMI ROAD)

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	0·48	1·46	0·63	.....	.....
1914	1·74	0·51	0·46	1·15	.....	.....	0·00	1·80	4·31	0·53	2·08	1·78	.....
1915	1·60	0·88	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Snowfall in Jan., 1914, 10·2 in.; Feb., 1·1; Nov., 10·3; Dec., 17·8. In Jan., 1915, 16·0; Feb., 4·3 in.

196 PERRY SIDING—Elevation, 1,700 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	0·73	2·33	4·15	1·41	2·36	1·77	1·34	2·12	0·71	.....
1914	4·75	1·14	1·19	2·92	1·70	1·83	0·98	0·46	3·51	1·59	2·51	1·21	24·7[illegible]
1915	1·23	1·31	1·96	3·66	2·76	2·54	3·36	0·71	1·[illegible]	2·59	[illegible]	3·04	28·1[illegible]
Means	2·99	1·23	1·53	2·44	[illegible]	2·84	1·92	1·18	2·15	1·84	3·16	1·65	25·5[illegible]

Snowfall in Oct., 1913, 0·8 in.; Nov., 10·5; Dec., 6·6. In Jan., 1914, 28·3; Feb., 9·9; Mar., 3·6; Nov., 6·7; Dec., 12·1; total in 1914, 60·6. In Jan., 1915, 12·3; Feb., 10·4; Nov., 23·2; Dec., 27·4; total for 191[illegible] 73·3 in.

197 [illegible]—Elevation, 4,800 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	2·55	1·73	2·50	5·40	2·69	.....
1914	5·56	1·80	1·99	3·07	0·99	3·[illegible]	0·78	0·60	3·22	1·88	1·23	2·40	26·7[illegible]
1915	3·00	2·90	1·55	2·10	5·83	2·58	4·70	0·[illegible]	0·58	1·75	3·60	2·50	31·4[illegible]

Snowfall in Oct., 1913, 10·0 in.; Nov., 54·0; Dec., 26·0. In Jan., 1914, 50·0; Feb., 18·0; Mar., 17·0; Apr[illegible] 9·5; Nov., 12·0; Dec., 24·0; total in 1914, 130·5. In Jan., 1915, [illegible]; Feb., 29·0; Mar., 9·0; April, [illegible] Oct., 5·3 in.

198 PILOT BAY—Elevation, 1,780 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4·07	4·23	.....
1894	3·54	4·32	4·18	2·82	5·60	2·61	0·31	0·13	5·46	3·56	2·82	2·92	
1895	4·38	3·90	0·80	1·75	8·49	0·41	4·06	0·14	4·20	0·40	5·42	2·90	35·7[illegible]
1896	13·19	3·34	0·20	1·31	1·18	1·06	0·70	0·74					
1897	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1898	.....	.....	.....	.....	1·20	0·80	1·09	1·81	1·38	2·00	2·36	2·82	
1899	3·10	3·75	1·17	1·40	1·99	1·43	0·48	4·58	1·31	2·12	2·55	6·[illegible]	30·5[illegible]
1900	8·57	3·03	6·43	3·37	7·34	10·9[illegible]	2·18	3·[illegible]	0·98	.....	.....	.....	.....
1901	3·71	5·38	0·64	4·87	5·17	.....	.....	.....	.....	.....	.....	0·[illegible]	.....
Means	6·08	3·95	2·24	2·59	4·42	2·88	1·63	1·77	2·67	2·02	3·44	3·32	37·01

During 1893-1901 (3 years complete), average monthly snowfall was: Jan., 32·3 in.; Feb., 21·6; Mar., 7·1; April, 0·5; Nov., 7·4; Dec., 15·6. Mean annual snowfall, 84·5 in.; maximum recorded, 119·5 in., Jan., 1896.

199 POINT GREY—Elevation, near sea-level

Station started recording January, 1916.

200 PORT ESSINGTON—Elevation, 10 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1900	.....	.....	.....	9·00	6·87	9·20	4·04	7·20	4·87	16·40	15·39	17·38	.....
1901	14·83	9·57	12·16	6·62	4·13	2·93	3·27	12·95	5·64	21·31	17·24	25·78	13[illegible]
1902	12·22	5·64	12·24	3·70	4·14	4·25	4·45	13·06	14·18	9·07	27·57	17·43	127·95
1903	15·72	4·97	3·80	8·40	7·28	2·87	2·11	2·97	17·30	25·09	15·07	13·49	11[illegible]·97
1904	20·77	4·21	4·46	5·76	5·30	7·44	5·56	.....	.....	20·75	17·52	.....	.....
1905	3·06	8·47	8·32	7·08	5·30	0·63	3·04	14·19	13·60	.....	23·00	.....	.....
Means	13·32	6·57	8·20	6·76	5·50	4·57	3·74	10·09	11·10	18·52	19·30	18·52	126·1[illegible]

During 1901-05 (1901-03 complete), average monthly snowfall was: Jan., 23·5 in.; Feb., 15·0; Mar., 8·5; April, 0·6; Nov., 5·0; Dec., 15·0. Mean annual snowfall, 67·4 in.; maximum recorded, 71·0 in., Jan., 1904.

201 PORT MOODY (DOMINION STATION)—Elevation, 65 ft.

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1886	.....	.....	.....	.....	.....	.....	.....	.....	.....	6·31	10·53	17·41	.....
1887	12·16	8·08	11·06	.....	.....	0·21	0·22	0·47	3·75	6·78	13·41	14·96	.....
1888	8·28	4·88	8·11	5·72	0·88	6·64	4·00	0·50	2·75	10·28	8·48	11·87	72·[illegible]
1889	5·85	6·05	5·45	3·20	3·84	1·00	0·00	4·25	3·99	5·81	6·64	7·52	53·[illegible]
1890	6·40	3·39	6·50	4·49	2·36	5·03	2·56	3·20	2·85	12·90	4·34	15·13	69·15
1891	11·37	3·04	7·30	5·60	2·40	3·33	1·65	2·10	8·59	5·13	14·29	18·07	82·87
1892	8·05	5·46	6·31	6·11	.....	.....	2·83	.....	.....	.....	.....	.....	.....
Means	8·68	5·18	7·46	5·02	2·37	3·24	1·88	2·10	4·39	7·87	9·62	14·16	7[illegible]·4

During 1886-92 (1888-91 complete), average monthly snowfall was: Jan., 9·7 in.; Feb., 5·8; Mar., 1·5; Nov., 0·8; Dec., 10·6. Mean annual snowfall, 28·4 in.; maximum recorded, 28·0 in., Jan., 1888.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

PORT MOODY (PROVINCIAL STATION)—Elevation, near sea-level

202

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	11·97	5·16	4·66	4·25	1·51	4·04	0·63	0·72	7·36	8·98	12·40	2·40	64·08
1915	7·82	4·63	5·04	2·79	4·55	0·79	1·42	0·26	1·00	11·06	6·78	11·18	57·27

Snowfall in Jan., 1914, 6·0 in. Total in 1915, 3·0., all in Dec.

PORT SIMPSON—Elevation, 26 ft.

203

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1886			......	......	......	3·60	3·50	9·80	8·69	17·43	12·61	6·18	......
1887	11·97	2·70	8·89	8·91	3·70	3·30	6·41	3·61	13·14	11·98	16·72	10·38	101·62
1888	5·72	17·85	7·37	8·07	4·59	5·71	3·00	7·65	10·77	18·04	13·56	6·31	108·64
1889	9·34	7·15	7·65	6·42	6·47	5·05	3·48	14·11	10·86	10·70	12·70	9·40	103·33
1890	6·40	4·53	8·45	8·73	3·20	5·06	4·44	6·78	15·23	12·83	19·25	13·10	108·00
1891	11·69	6·19	7·79	7·42	2·98	1·74	9·41	......	......	4·88	18·34	20·15	......
1892	12·32	7·75	7·70	......	......	......	6·29	13·23	8·29	14·25	8·80	11·26	......
1893	16·74	6·98	5·03	0·41	6·02	6·03	4·59	4·46	9·73	11·80	7·82	12·54	92·18
1894	6·52	9·35	2·88	14·71	8·09	4·43	8·92	9·08	9·62	16·99	23·90	12·56	127·05
1895	6·50	12·82	2·28	9·70	3·59	5·30	3·56	6·76	9·48	11·80	12·98	11·93	96·70
1896	7·63	11·38	6·29	1·90	2·55	5·39	3·59	2·42	3·49	9·08	4·54	19·88	78·14
1897	15·79	7·84	7·71	8·13	9·84	3·43	7·15	4·81	14·63	15·57	3·36	11·05	109·22
1898	12·60	5·26	4·59	7·95	3·76	1·97	6·95	1·12	7·03	14·53	11·77	14·94	91·87
1899	14·09	12·53	1·03	9·35	4·05	7·50	4·34	4·39	7·65	13·86	9·32	5·68	94·39
1900	5·20	6·23	5·82	6·47	4·86	4·58	2·72	4·51	1·38	5·11	4·77	11·88	63·53
1901	7·50	6·26	7·39	5·13	3·13	2·30	2·04	11·66	5·85	14·48	13·00	13·12	91·86
1902	6·73	5·51	8·47	2·63	2·20	3·55	3·03	10·05	8·60	6·71	9·60	7·58	74·66
1903	7·53	3·70	1·41	3·41	4·68	2·66	1·52	2·80	7·88	15·24	9·43	9·07	69·33
1904	15·30	1·95	3·03	6·96	5·46	7·04	7·77	1·74	11·47	10·93	11·45	6·51	89·61
1905	2·21	5·99	5·30	6·68	6·38	1·20	4·71	10·94	9·33	8·80	11·02	10·96	83·52
1906	9·96	1·93	2·84	7·53	1·98	5·42	3·30	8·76	7·42	11·59	8·18	5·23	74·14
1907	1·08	11·20	5·63	3·39	1·63	3·49	3·52	......	4·32	9·83	12·02	5·94	......*
1908	5·39	3·62	7·96	8·63	4·61	3·54	4·84	4·47	19·12	13·76	8·66	6·67	91·27
1909	3·25	4·43	4·33	2·24	3·55	3·17	6·82	7·62	17·68	13·70	7·41	3·26	77·46
1910	7·15	7·85	11·42	10·17	4·20	8·42	......	......	......	......	......	......	49·21*
Means	8·71	7·13	5·88	6·74	4·42	4·33	4·83	6·85	9·64	12·23	11·30	10·23	92·29

During 1886-1910 (20 years complete), average monthly snowfall was: Jan., 10·1 in.; Feb., 11·0; Mar., 6·5; April, 2·7; Nov., 1·7; Dec., 7·8. Mean annual snowfall, 39·8 in.; maximum recorded, 42·6 in., Jan., 1887

* Total for 6 months, see Prince Rupert.

POWELL RIVER*—Elevation, near sea-level

204

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	......	......	......	......	2·34	2·25	0·00†	0·81	1·29	4·69	7·43	5·88	......
1911	6·50	3·25	1·37	1·13	3·62	1·37	2·13	1·23	3·14	2·24	6·60	3·54	36·12
1912	4·07	2·15	0·52	1·61	3·18	2·47	0·84	3·38	2·36	2·92	6·50	5·37	35·37
1913	2·85	3·26	2·08	1·43	2·22	4·15	1·78	1·39	3·18	5·44	6·68	2·28	36·74
1914	8·98	3·01	2·70	2·89	1·12	2·56	0·38	0·78	5·15	7·70	6·38	3·29	44·94
1915	2·96	3·39	2·38	3·15	2·26	0·26	1·49	0·21	0·39	7·00	3·10	7·57	34·16
Means	5·07	3·01	1·81	2·04	2·46	2·18	1·10	1·30	2·59	5·00	6·12	4·66	37·34

† No rain June 20 to August 12, 1910.

Snowfall not usually recorded separately. In Dec., 1914, 1·0 in., and in Dec., 1915, 1·5 in.

POWELL RIVER (GOAT RIVER LODGE)—Elevation, 160 ft.

205

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	2·47	3·85	1·12	0·79	7·97	13·22	13·26	2·47	......
1915	5·98	6·88	5·01	6·29	4·89	1·02	3·92	0·65	0·50	14·54	7·03	12·51	69·22

Snowfall in Dec., 1915, 12·0 in.

POWELL RIVER (HEAD OF LAKE)—Elevation, 160 ft.

206

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	7·25	3·23	3·06	1·28	1·01	9·31	17·93	20·86	4·71	......
1915	8·09	9·58	7·77	8·98	5·00	0·62	4·37	0·70	1·25	21·53	11·93	18·48	98·30

Snowfall in Dec., 1915, 29·6 in.

PRINCE GEORGE—Elevation, 1,863 ft.

91

Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	2·22	0·55	1·43	1·50	1·10	......
1913	3·43	2·88	4·48	2·80	1·92	2·40	1·02	1·86	3·50	2·10	0·42	......	......
1914	......	......	0·94	1·48	1·38	1·10	3·25	2·00	1·68	0·53	0·83	1·38	......
1915	0·15	0·10	0·85	1·23	2·22	1·67	1·91	1·46	1·26	......	......	......	......

Snowfall in Oct., 1912, 1·5 in.; Nov., 6·3; Dec., 11·0. In Jan., 1913, 24·3; Feb., 17·3; Mar., 8·8; Oct. 2·2; Nov., 4·0. In Nov., 1914, 4·3; Dec., 13·8. In Jan., 1915, 1·5; Feb., 1·0 in.

* Records supplied by Powell River Company.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

PRINCE RUPERT*—Elevation, 170 ft.

207

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1908								3·40	20·35	18·02	13·36	8·42	
1909	9·39	8·98	9·64	6·29	8·07	3·31	7·70	9·98	19·99	19·17	7·40	3·88	113·
1910	4·70	6·72					4·50	4·83	8·60	18·13	9·17	24·64	
1911	15·30	7·09	19·92	8·64	4·33	5·29	6·04	3·67	4·23	7·49	8·40	13·19	103·
1912	4·41	8·50	2·75	8·66	2·94	4·09	3·44	4·70	8·39	12·41	13·52	16·21	90·
1913	11·33	5·73	14·11	8·86	6·75	3·36	7·73	5·08	13·74	15·91	14·60	19·08	126·
1914	6·36	10·24	9·13	9·10	6·43	1·68	17·25	4·16	10·19	11·97	11·91	6·56	104·
1915	12·95	7·57	10·57	12·50	3·07	5·63	1·28	6·75	9·66	17·08	11·77	11·64	110·
Means	9·21	7·83	11·02	9·01	5·26	3·93	6·85	5·32	11·89	15·02	11·27	12·95	109

During 1908-15 (1910-15 complete), average monthly snowfall was: Jan., 21·5 in.; Feb., 9·3; Mar., 3 April, 3·5; Oct., 0·2; Nov., 2·6; Dec., 4·5. Mean annual snowfall, 44·7 in.; maximum recorded, 61·9 in., Ja 1911.

PRINCETON—Elevation, 2,111 ft.

208

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1894	0·60	0·40	0·50	1·10	1·64	1·00	0·00	0·04	0·64	0·77	2·15	0·30	9·
1895	0·30	0·30	0·00	1·40	0·37	0·00	1·60	0·00	0·42	0·00	2·20	4·15	10·
1896	1·60	1·05	0·55			0·20	1·00	1·40	1·20	1·90	8·40	1·00	
1897	1·20	0·00	0·00	0·00	1·89	1·45	0·91	0·18	1·80	1·05		0·00	
1898	0·25	0·50	0·60	0·00			0·20	0·61	2·15	1·00	0·86	1·35	
1899	1·38		0·51										
1900													
1901	0·49	0·95	0·38	0·17	1·03	1·04	4·53	0·05	1·00	0·11	1·06	0·68	11·4
1902	2·31	0·71	0·71	0·40	1·67	0·62	1·68	1·64	0·46	0·20	4·37	1·98	16·7
1903	1·19	0·48	1·99	0·33	0·80	1·74	2·68	2·05	2·59	0·80	0·93	1·03	16·6
1904	1·80	3·12	1·46	1·82	0·65	0·84	0·68	0·72	0·09	0·37	1·79	2·01	15·3
1905	1·14	0·36	1·00	0·78	1·56	1·12	2·07	0·95	1·64	1·58	0·38	0·52	13·1
1906	0·71	0·86	0·06	0·18	3·27	1·63	0·11	0·11	0·62	1·25	1·97	3·25	14·0
1907	2·30	1·31	0·49	0·27	1·03	0·88	0·83	1·87	2·02	0·25	0·90	1·12	13·2
1908	1·36	1·29	0·76	0·14	1·21	1·02	1·02	0·93	0·31	0·60	0·53	1·89	11·0
1909	2·18	1·33	0·13	0·45	2·14	1·20	2·16	0·20	0·73	1·22	3·16	0·38	15·2
1910	1·55	1·84	0·67	0·00	0·95	2·36	0·63	0·90	0·70	1·19	2·26	1·70	14·8
1911	1·35	1·13	0·29	0·11	1·76	0·86	0·63	1·34	1·49	0·27	3·12	0·65	13·0
1912	1·59	0·76	0·24	1·15	0·72	1·53	1·30	2·08	0·49	1·20	0·91	1·55	13·5
1913						2·54	2·22	4·14		1·17	0·75	0·50	
1914	2·36	1·16	0·73	0·65	1·32	0·88	0·21	0·12	1·39	1·00	2·04	0·96	12·8
1915	0·75	0·23	0·76	0·41	2·54	0·96	2·56	1·36	1·07	1·00	2·02	1·67	15·3
Means	1·32	0·94	0·59	0·53	1·44	1·16	1·35	1·03	1·04	0·85	1·83	1·33	13·4

During 1894-1915 (16 years complete), average monthly snowfall was; Jan., 10·1 in.; Feb., 8·0; Mar., 3·5 April, 0·2; May, 0·1; Oct., 0·2; Nov., 9·5; Dec., 11·1. Mean annual snowfal, 42·7 in.; maximum recorde 38·7 in., Nov., 1902.

PRINCETON CROSSING—Elevation, 3,515 ft

209

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1914										0·92	1·44	1·57	
1915	1·17	0·41	2·77	1·48	3·88	2·03	3·70	0·72	2·37	2·33	2·78	3·24	26·88

Snowfall in Nov., 1914, 6·7 in.; Dec., 15·7. In Jan., 1915, 11·7. Feb., 4·1; Mar., 4·5; Nov., 26·0 D 32·4; total in 1915, 78·7 in.

QUALICUM†—Elevation, near sea-level

210

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1908												5·46	
1909	7·39	4·58	0·90	0·50	1·60	0·95	0·60	2·40	2·40	10·28	4·09	0·30	35·99
1910	5·11	3·69	1·85	0·50	0·74	1·90	0·10	0·86	1·35	6·18	8·06	3·51	33·85
1911	7·38	1·92	0·45	0·86	2·75	0·50	0·10	0·87	2·05	3·02	6·68	2·80	29·38
1912	6·36	3·53	0·28	1·29	1·93	1·20	1·98	2·12	1·58	2·61	7·84	5·80	36·52
1913	4·77	2·31	1·80	1·46	1·76	2·73	1·52	0·85	2·51	3·60	9·95	2·49	35·75
1914	11·96	3·16	2·48	5·71	0·49	2·66	0·07	0·22	5·00	8·13	9·05	2·02	50·[illegible]
1915	3·07	3·81	2·60	2·11	2·83	0·85	0·14	0·02	0·75	8·83	4·17	8·80	38·[illegible]
Means	6·58	3·29	1·48	1·78	1·73	1·54	0·64	1·05	2·23	6·10	7·12	3·90	37·41

During 1909-15 (1909-12 complete), average monthly snowfall was: Jan., 9·1 in.; Feb., 2·0; Nov., 3·3 D 0·9. Mean annual snowfall, 15·3 in.; maximum recorded, 28·0 in., Jan., 1911.

QUALICUM BEACH—Elevation, near sea-level

211

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann
1913												1·81	
1914	7·75	2·39	2·34	2·88	0·39	2·41	0·28	0·34	4·77	8·01	7·15	1·07	39·78
1915	2·72						0·04	0·05	0·10	7·00	0·46	1·84	

Snowfall in Jan., 1914, 6·0 in.; Feb., 0·3; Dec., 1·3. In Jan., 1915, 0·0; Dec., 0·7 in.

* See also record for Port Simpson.

† Formerly called Little Qualicum. See also record for French Creek.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

212 QUAMICHAN—Elevation, 100 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1885	......	......	......	......	1·56	0·65	0·64	0·01	3·95	3·42	8·63	3·94	......
1886	7·75	0·74	1·61	3·38	1·56	1·28	1·97	1·19	2·01	2·36	2·09	13·24	39·18
1887	3·86	8·[illegible]	4·12	2·24	3·65	0·92	......	0·00	......	......	......	......	......
1888	......	......	......	......	......	......	1·55	0·72	1·27	3·61	2·84	6·30	......
1889	3·46	3·98	1·79	2·52	2·87	0·76	0·00	1·04	3·08	4·93	3 23	5·28	32·94
1890	8·26	1·73	2·94	0·98	1·28	3·86	0·74	0·27	1·11	6·31	1·39	10·20	39·14
1891	2·96	2·45	3·60	5·86	0·60	0·26	0·00	2·53	3·81	3·60	7·50	10·22	43·?9
1892	5·40	2·86	2·72	4·09	2·26	0·[illegible]	1·10	0·80	3·60	1·80	5·75	5·00	35·78
1893	2·85	7·93	5·05	4·59	2·32	1·72	0·37	0·21	3·65	2·97	7·90	5·60	45·16
1894	7·35	4·05	4·45	2·30	0·60	1·80	1·30	0·20	3·00	4·50	2 92	2·05	34·52
1895	6·37	1·00	3·50	2·20	4·20	0·90	0·50	0·40	0·50	0·70	4·30	4·70	29 27
1896	7·45	6·13	0·03	......	2·80	0·20	0·10	0·90	......	......	......	1·64	......
1897	......	......	......	......	......	......	......	......	......	......	......	......	......
1898	......	......	......	1·60	......	......	......	......	......	......	......	1·50	......
1899	......	......	......	......	......	......	......	......	......	......	......	7·15	......
1900	......	......	......	......	1·65	0·65	......	......	0·60	4·00	......	......	......
1901	......	[illegible]·61	1·15	2 43	1·94	1·91	0·34	0·31	1·40	2·31	11·03	5·81	......
Means	5 57	3·95	2·81	2·93	2·10	1·18	0·72	0·66	2·33	3·38	5·24	5·91	36·78

During 1886-1901 (1889-95 complete), average monthly snowfall was: Jan., 11·9 in.; Feb, 13·8; Mar, 1·4; Oct., 0·1; Nov., 1·0; Dec, 5·3. Mean annual snowfall, 38·5 in.; maximum recorded, 58·5 in., Feb., 1893.

213 QUATSINO (AND WINTER HARBOUR)—Elevation, near sea-leve

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	......	......	......	......	......	......	3·74	3·35	10·63	5·95	22·33	13·17	......
1896	7·13	16·17	7·14	5·91	4·70	10·59	2·05	0·75	1·04	13·49	9·27	30·33	108·57
1897	10·52	7·84	7·25	10·61	6·25	5·26	7·09	6·60	4·55	10·27	11·33	14·96	102·53
1898	15·91	17·57	5·84	13·30	6·61	5·05	4·04	0·24	8·83	10·88	16·23	14·34	118·84
1899	19·79	15·83	7·77	18 15	7·51	1·60	0·30	1·42	6·45	11·86	25·08	19·81	135·57
1900	......	......	12·22	6·68	10·00	6·20	2·23	3·89	2·84	18·49	8·68	13·94	......
1901	14·66	11·07	15·09	......	......	......	5·39	2·58	3·63	12·18	24·84	20·88	......
1902	7·92	16·99	17·96	8·06	4·21	3·65	3·22	6·89	7·68	7·68	18·21	22·58	125·05
1903	14·94	1·43	3·40	10·93	6·01	5·77	0·80	4·86	13·66	14·23	20·70	19·74	116·47
1904	3·10	5·60	2·89	4·37	5·53	6·51	2·39	0·12	6·86	15·60	25·39	16·75	95·14
1905	9·14	12·56	15·11	6·24	6·26	0·51	1·11	8·63	14·27	11·82	18·15	22·38	126·18
1906	19·51	8·32	10·06	6·86	3·06	9·38	2·06	5·37	18·92	25·55	13·88	23·42	146·39
1907	6·73	16·74	10·32	......	......	1·30	0·74	3·99	0·44	4·95	......	......	......
1908	......	......	......	......	9·70	3·96	5·82	2·47	8·59	10·63	18·09	10·65	......
1909	8·80	11·90	12·96	2·17	5·39	5·02	5·00	15·62	7·55	......	15·01	6·68	......
1910	19·21	9·23	10·66	8·29	5·54	5·85	1·11	2·11	0·51	12·75	11·23	19·27	105·70
1911	......	12·84	10·23	3·09	3·58	5·79	1·78	0·30	5·49	......	17·46	14·98	......
1912	14·88	8·03	1·71	3·91	2·82	1·15	1·31	1·84	1·51	1·65	14·73	14·02	67·56
1913	14·09	5·31	4·26	7·44	5·97	1·10	2·67	5·78	10·69	9·19	19·10	13·95	99·55
1914	18·46	5·76	12·42	9·36	3·85	1·34	0·74	1·05	5·22	14·51	17·35	5·18	95·24
1915	8·58	9·90	7·71	6·77	2·82	0·46	1·70	2·47	1·94	18·99	12·84	14·19	88·37
Means	12·54	10·72	9·21	7·77	5·55	4·24	2·63	3·82	6·73	12·14	17·04	16·56	108·95

During 1895-1915 (14 years complete), average monthly snowfall was: Jan., 7·8 in.; Feb, 4·8; Mar, 2·7; April, 3·6; Oct., 0·2; Nov, 2·6; Dec, 2·9. Mean annual snowfall, 24·6 in.; maximum recorded, 39·0 in., Dec., 1902.

214 QUEEN CHARLOTTE CITY—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	......	......	......	......	2·73	......	3·03	......
1915	7·41	5·30	5·25	5·98	1·60	0·91	1·53	2·97	3·59	14·06	11·77	12·76	73·16

Snowfall in Feb., 1915, 7·0 in.; Dec., 3·5; total in 1915, 10·5 in.

215 QUESNEL—Elevation, 1,700 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	1·30	1·35	0·37	0·63	0·41	0·73	1·10	1·54	3·59	0·40	0·27	0·00	11·69
1896	0·90	0·00	0·00	......	0·52	0·66	0·13	......	......	......	1·00	0·30	......
1897	......	......	......	0·55	0·21	1·53	1·94	0·73	2·12	1·01	......	......	......
1898	......	......	......	0·11	1·78	1·11	1·03	0·32	1·56	0·29	1·10	0·00	......
1899	0·50	3·00	0·00	0·00	0·98	2·62	1·82	2·74	0·21	1·27	1·93	0·62	15·69
1900	1·25	1·65	1·46	0·82	0·67	2·59	2·46	3·00	1·45	0·62	1·36	0·10	17·43
1901	1·10	0·05	0·00	0·00	0·68	1·95	2·31	......	......	......	0·30	0·70	......
1902	0·40	......	......	0·02	1·03	1·76	0·81	1·06	1·84	0·32	0·45	0·20	......
1903	1·70	0·00	......	......	......	0·47	3·22	2·37	2·63	1·50	1·09	1·65	......
1904	2·49	2·45	1·40	0·10	0·50	1·55	1·35	0·07	0·53	1·50	1·50	2·80	16·30
1905	0·95	1·05	T	0·36	0·82	0·31	0·53	2·46	0·51	1·78	2·03	0·60	11·38
1906	2·25	0·15	0·30	0·02	0·46	1·62	1·07	0·50	2·55	2·90	1·15	2·70	15·67
1907	2·10	0·60	0·55	0·53	0·66	3·46	1·42	3·13	2·20	0·68	0·87	1·05	17·25
1908	0·97	2·10	0·25	0·18	1·43	2·67	2·28	1·81	3·64	1·36	1·53	0·85	19·07

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
QUESNEL—*Continued*													
1909	0·55	0·83	0·50	0·42	1·04	1·53	0·82	1·50	2·13	2·49	1·40	0·25	13·4
1910	0·57	1·00	0·51	0·20	1·41	2·92	1·11	2·48	0·63	0·85	2·42	1·35	15·4
1911	1·05	0·70	0·72	0·43	1·36	1·33	1·84	1·07	2·20	0·39	1·96	2·35	15·4
1912	0·45	0·55	0·10	0·88	0·40	1·08	1·66	1·94	0·70	1·31	0·97	0·50	10·5
1913	2·20	1·03	1·18	0·31	1·36	1·55	3·47	3·65	1·51	2·97	0·87	0·42	20·5
1914	1·52	1·84	0·83	0·81	1·21	2·37	2·76	0·30	1·39	0·07	1·77	0·80	15·67
1915	0·25	0·15	0·47	0·72	1·38	2·08	1·82	0·79	1·24	1·24	0·05	1·90	12·09
Means	1·25	1·03	0·45	0·37	0·87	1·71	1·66	1·66	1·72	1·21	1·20	0·96	14·0

During 1895-1915 (15 years complete), average monthly snowfall was: Jan., 11·2 in.; Feb., 9·1; Mar., 2·2
Oct, 0·6; Nov., 6·4; Dec., 8·0. Mean annual snowfall, 37·5 in.; maximum recorded, 30·0 in., Feb., 1899.

QUESNEL FORKS (BULLION)—Elevation, 2,273 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1897	......	......	......	......	......	2·63	3·54	0·56	1·71	1·91	2·80	2·31	......
1898	3·28	2·97	2·40	0·96	3·31	3·36	3·06	0·31	2·71	1·06	2·83	1·31	27·56
1899	3·70	4·75	2·39	2·21	2 35	2·54	1·39	2·94	1·54	1·64	2·47	1·43	29·35
1900	2·33	3·20	1·24	0·83	2·23	3·90	1·83	6·07	1·85	1·94	2·91	1·70	30·03
1901	1·92	0·82	1·48	2·00	1·60	2·95	1·52	0·53	2·94	1·70	2·34	2·74	22·63
1902	1·23	1·37	1·14	1·76	2·29	2·76	1·31	3·16	2·78	0·40	2·35	1·33	21·88
1903	1·98	0·60	1·09	1·09	1·71	3·78	2·40	2·76	5·19	2·95	1·08	2·20	27·03
1904	4·15	2·25	0·35	0·72	0·87	2·10	2·04	0·12	0·72	2·46	0·87	1·60	18·25
1905	0·90	1·43	0·52	0·98	2·26	1·17	0·45	1·55	1·34	2·17	3·43	1·40	17·60
1906	1·78	0·12	0·30	0·81	1·26	3·26	1·45	0·50	2·95	3·53	2·12	3·57	21·65
Means	2·36	1·95	1·21	1·27	1·99	2·85	1·92	1·83	2·37	1·98	2·32	1·96	24·03

During 1897-1906 (1897 incomplete), average monthly snowfall was: Jan., 20·7 in.; Feb., 17·8; Mar., 9·4;
April, 4·1; May, 0·5; Oct., 1·0; Nov., 14·3; Dec., 17·7. Mean annual snowfall, 85·5 in.; maximum recorded,
65·0 in., Feb., 1899.

QUILCHENA (DRY FARM)—Elevation, 2,900 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	0·39	0·66	0·70	1·36	0·97	0·40	......
1914	2·61	0·70	0·87	0·51	1·76	1·43	0·00	0·02	1·96	0·45	1·65	0·97	12·93
1915	0·85	0·70	0·59	0·48	3·72	2·53	1·88	0·31	1·34	0·94	1·05	2·25	16·64

Snowfall in Oct., 1913, 1·5 in.; Nov., 6·8; Dec., 1·0. In Jan., 1914, 18·7; Feb., 7·0; Mar., 8·7; Nov., 10·0;
Dec., 9·7; total in 1914, 54·1. In Jan., 1915, 8·5; Feb., 7·0; Nov., 9·5; Dec., 18·5; total in 1915, 43·5 in.

REVELSTOKE—Elevation, 1,476 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1898	......	......	......	......	1·96	3·84	3·73	0·14	2·73	4·56	4·86	3·65	......
1899	5·65	5·45	2·82	1·82	3·48	2·01	1·42	5·33	2·03	3·66	7·12	5·72	46·51
1900	4·04	4·74	2·87	1·93	3·02	......	......	......	......	......	......	......	......
1901	......	......	......	......	......	......	......	......	......	......	......	......	......
1902	0·80	......	......	1·49	3·65	3·41	9·68	4·65	3·75	8·47	6·20	0·30	......
1903	5·50	0·85	4·81	2·07	1·92	3·94	......	......	8·14	3·47	3·79	4·25	......
1904	6·12	5·51	2·87	1·65	1·43	3·67	1·61	1·53	1·74	1·03	4·93	5·02	37·08
1905	3·20	4·83	2·37	0·78	2·94	2·54	1·19	1·43	5·68	5·43	2·73	4·23	37·35
1906	4·90	3·71	0·37	1·54	2·08	5·44	1·62	0·88	4·40	6·54	4·71	4·01	40·20
1907	6·55	6·26	3·47	3·25	2·67	2·54	0·53	7·02	4·34	2·28	6·09	4·09	49·09
1908	6·65	6·70	4·65	2·56	2·23	2·61	1·33	1·78	1·79	2·88	5·58	2·42	41·19
1909	6·17	6·62	1·63	......	1·49	3·29	2·32	1·36	2·88	4·40	7·22	3·62	......
1910	3·33	4·92	4·43	4·30	0·67	2·51	0·89	1·61	2·15	6·19	6·47	8·71	46·18
1911	7·55	3·27	2·98	0·83	2·59	2·13	2·57	1·63	2·64	0·46	5·14	4·30	36·09
1912	5·21	3·32	0·72	1·93	1·86	2·29	4·13	4·03	1·49	4·96	5·98	8·15	44·07
1913	7·57	2·91	1·29	0·88	2·25	1·73	3·05	4·60	3·26	3·08	6·90	3·75	41·27
1914	9·80	2·06	3·23	2·42	1·25	2·53	0·97	1·19	3·87	2·23	7·09	1·65	38·38
1915	3·40	2·18	0·84	3·19	4·83	2·93	4·91	0·72	2·51	0·87	3·68	5·12	35·18
Means	5·41	4·22	2·62	2·04	2·37	2·96	2·66	2·53	3·34	3·79	5·53	4·31	41·78

During 1898-1915 (1899 and 1903-15 complete), average monthly snowfall was: Jan., 43·9 in.; Feb., 32·6;
Mar., 11·5; April, 0·4; May, 0·1; Oct., 0·1; Nov., 19·1; Dec., 34·4. Mean annual snowfall, 142·1 in.; maxi-
mum recorded, 77·5 in., Dec., 1912.

RICHLANDS—Elevation, 2,500 ft.

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TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	0·35	2·37	0·00	0·12	1·94	3·96	2·14	1·64	1·15	2·76	1·09	0·00	17·52
1914	1·61	0·72	0·20	1·45	1·43	2·08	1·74	0·74	2·81	2·41	2·02	0·73	17·94
1915	1·60	0·73	0·47	2·08	4·98	3·11	3·02	0·83	2·20	1·57	0·46	0·80	21·85

Snowfall in Jan., 1913, 2·5 in.; Feb., 9·7; April, 0·4; Nov., 0·0; Dec., 0·0. In Feb., 1914, 5·0; Mar., 2·0;
Nov., 6·5; Dec, 7·3, total in 1914, 20·8. In Jan., 1915, 16·0; Feb., 3·0; April, 0·5; May, 2·0; Nov., 0·0;
Dec., 6·0; total in 1915, 27·5 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

RIVERS INLET—Elevation, 20 ft.

220

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1894	12·93	10·25	8·47	16·53	6·88	3·34	4·13	8·03	16·40	14·78	17·93	7·07	126·74
1895	8·37	15·89	9·85	7·35	5·78	5·00	4·03	6·12	10·72	6·76	19·72	19·13	118·72
1896	14·27	18·73	8·17	4·78	3·03	8·77	1·42	1·20	1·79	13·50	9·26	17·77	102·69
1897	8·60	9·58	8·08	10·09	5·11	3·39	5·02	5·99	6·37	14·16	8·46	11·29	96·14
1898	12·23	10·59	3·40	7·83	3·10	4·08	4·06	0·52	8·00	9·57	19·29	20·14	102·81
1899	18·35	17·43	11·40	14·03	6·51	1·96	1·21	2·17	8·07	13·18	12·80	15·80	122·91
1900	15·81	10·95	11·33	9·88	9·73	6·28	4·54	4·76	3·29	19·61	8·59	13·94	118·71
1901	11·12	9·39	10·50	6·99	7·42	3·30	6·60	3·43	4·43	18·13	20·12	20·78	122·21
1902	3·51	8·99	11·44	4·86	4·96	3·61	4·68	9·18	10·08	8·23	16·17	19·23	104·94
1903	10·21	4·05	4·16	7·27	6·68	4·86	2·34	7·47	15·16	22·58	23·97	13·96	122·71
1904	17·75	9·56	2 57	5·94	5·43	6·64	3·02	0·24	10·69	14·42	21·36	13·56	111·18
1905	8·75	8·22	9·96	6·83	4·30	0·29	1·10	8·40	17·68	9·76	21·14	20·09	116·52
1906	18·45	3·56	5·70	7·84	1·89	5·09	2·19	4·85	23·00	26·85	13·54	21·62	134·58
Means	12·33	10·55	8·08	8·48	5·45	4·35	3·41	4·79	10·44	14·73	16·33	16·49	115·43

During 1894-1906, average monthly snowfall was: Jan., 11·8 in.; Feb., 14·1; Mar., 15·3; April, 4·3; May, 1·0; Nov., 6·9; Dec., 8·6. Mean annual snowfall, 62·0 in.; maximum, 63·8 in., Mar., 1894.

ROCK CREEK—Elevation, 1,992 ft.

221

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	1·66	0·89	1·02	1·12	0·98	......
1913	1·83	0·30	0·37	0·69	1·69	3·60	0·37	0·81	1·21	1·14	0·85	0·80	13·66
1914	1·83	1·01	0·34	0·89	1·11	1·68	0·36	0·08	1·02	0·99	1·53	0·90	11·74
1915	1·28	1·08	0·90	1·19	4·21	1·13	4·80	0·28	0·74	0·87	1·71	1·35	19·54

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 16·5 in.; Feb., 4·3; Mar., 0·8; Oct., 1·0; Nov., 5·4; Dec, 9·8. Mean annual snowfall, 37·8 in.; maximum recorded, 18·3 in., Jan., 1913, and Jan., 1914.

ROSSLAND—Elevation, 3,400 ft.

222

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1900	4·02	4·11	3·41	1·71	1·75	1·41	1·38	1·24	2·56	6·09	1·81	5·99	35 48
....	......	......	......	......	......	......	......	......	......	......	......	......	......
1905	3·95	1·79	3·84	1·47	2·94	2·71	1·63	0·46	2·64	3·75	3·03	2·82	31·03
1906	3·28	3·77	1·28	0·78	4·75	2·57	0·48	0·71	1·41	1·59	5·04	4·49	30·15
1907	3·78	1·74	2·76	2·17	3·58	2·87	0·88	5·89	4·28	1·37	3·24	3·81	36·37
1908	2·80	2·75	2·14	2·80	3·62	2·21	1·19	1·08	0·13	3·47	1·95	2·89	27·03
1909	3·58	5·05	1·76	0·29	3·85	1·55	3·35	0·14	2·82	3·11	4·60	2·83	32·93
1910	3·48	1·86	2·12	1·26	2·56	2·02	0·30	1·09	1·25	3·04	5·32	3·47	27·77
1911	3·55	1·80	1·40	1·13	5·64	2·68	1·10	1·33	2·20	0·61	3·27	4·39	29·10
1912	3·61	1·77	0·85	2·86	2·54	1·74	2·84	3·14	1·96	3·07	3·54	2·68	30·60
1913	4·09	0·26	2·17	0·71	3·32	4·15	1·24	0·71	1·19	1·56	3·98	1·37	24·75
1914	5·66	1·55	1·88	3·50	2·22	3·21	0·78	0·09	3·29	3·13	3·85	1·74	30·09
1915	1·61	2·31	2·41	3·80	5·85	3 43	4·18	0·07	0·76	2·75	3·97	3·51	34·65
Means	3·62	2·40	2·17	1·87	3·55	2·55	1·61	1·33	2·04	2·79	3·63	3·33	30·80

During 1900-15 (1901-04 no record), average monthly snowfall was: Jan., 30·9 in.; Feb., 20·6; Mar., 13·0; April, 4·1; Oct., 5·2; Nov., 23·2; Dec., 30·2. Mean annual snowfall, 127·2 in.; maximum recorded, 44·7 in., Feb., 1909.

RUSKIN (STAVE FALLS)—Elevation, 125 ft.

223

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909	......	......	......	......	......	......	......	......	......	2·72	19·82	5·92	......
1910	14·44	7·21	6·39	5·02	5·96	1·02	0·13	4·76	2·08	12·72	14·91	13·24	87·88
1911	9·85	2·74	6·31	2 59	7·35	1·65	1·97	2·76	7·65	2·62	17·77	10 75	73·99
1912	6·88	6·74	1·72	2·89	2·64	3·34	3·92	6·24	2·08	7·66	13·57	10·05	67·73
1913	8·28	8·25	8·93	4·52	5·13	5·45	3·22	3·63	5·81	9·55	11·82	3·93	78·52
1914	12·22	4·72	5·61	7·49	2·65	4·18	0·87	0·54	9·86	7·63	15·20	3·13	74·10
1915	8·31	5·51	4·12	5·34	5·40	2·49	2·84	0·14	1·77	14·32	7·56	13·02	70·82
Means	10·00	5·86	5·51	4·64	4·86	3·02	2·16	3·01	4·88	8·17	14·38	8·58	75·07

During 1909-15 (1909 incomplete), average monthly snowfall was: Jan., 18·9 in.; Feb, 4·8, Mar., 1·0; Nov., 3·0; Dec., 1·6. Mean annual snowfall, 29·3 in.; maximum recorded, 69·5 in., Jan., 1913.

SALMON ARM—Elevation, 1,150 ft.

224

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	......	......	......	2·10	0·93	3·80	1·12	0·93	0·48	2·98	2·99	2·30	......
1894	2·20	1·00	0·60	1·40	1·00	1·79	0·33	0·22	2·19	0·70	0·60	0·90	16·90
1895	2·00	1·55	0·75	1·14	2·64	0·42	1·24	0·00	3·64	0·26	0·72	0·51	14·87
1896	3·37	1·30	0·20	0·71	1·34	0·65	0·00	0·57	1·16	1·77	2·90	2·65	16·62
1897	......	......	0·25	0·50	......	......	......	......	......	......	......	......	......
....	......	......	......	......	......	......	......	......	......	......	......	......	......
1906	......	......	......	......	1·97	2·59	0·72	0·21	1·28	2·95	4·12	2·53	......
1907	2·80	1·28	1·33	0·66	1·49	1·83	1·75	1·90	3·23	0·31	1·38	0·45	18·41
1908	2·26	2·11	0·73	0·67	1·32	0·87	0·51	1·51	0·92	1·10	1·39	1·25	14·64
1909	3·15	2·32	1·59	0·31	0·90	2·26	3·22	0·50	2·16	1·10	2·68	1·52	21·71

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

SALMON ARM—*Continued*

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annu[al]
1910	0·79	1·60	0·59	0·58	0·92	3·12	0·89	1·08	0·73	2·22	5·00	2·38	21·[illegible]
1911	3·43	1·30	1·92	1·52	1·44	0·96	1·70	1·71	1·80	0·33	3·84	4·50	24·[illegible]
1912	2·60	1·13	0·03	1·55	0·66	0·87	2·14	2·08	1·21	1·48	2·51	2·11	18·3[illegible]
1913	3·85	1·13	0·60	0·38	1·39	3·16	1·92	1·45	1·31	2·00	1·88	0·[illegible]	19·[illegible]
1914	3·08	1·36	0·87	1·27	1·36	1·34	0·73	0·19	2·17	1·54	3·02	1·5[illegible]	18·[illegible]
1915	2·18	0·50	1·10	1·52	2·96	3·98	.....	.....	.....	.....	.....	.....	.....
Means	2·64	1·38	0·81	1·02	1·45	1·98	1·25	0·95	1·71	1·52	2·55	1·80	19·0[illegible]

During 1893-1914 (1897-1905 no record), average monthly snowfall was : Jan , 23·5 in.; Feb , 10·9 ; M[...]
2·5; Nov., 7·8 ; Dec., 16·1. Mean annual snowfall, 60·8 in ; maximum recorded, 38·5 in., Jan., 1913.

SALMON ARM (EXPERIMENTAL FARM)—Elevation, about 1,150 ft.

225

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	.....	.....	.....	.....	.....	.....	1·84	1·14	0·32	0·01	5·34	2·35	.....
1912	2·76	1·18	0·22	1·05	0·38	0·87	2·00	[illegible]·83	0·74	0·53	2·09	1·83	16·4[illegible]
1913	3·15	0·90	0·51	0·52	1·26	2·72	1·83	0·78	1·74	1·84	1·33	0·78	17·3[illegible]
1914	3·59	1·45	0·99	0·97	0·96	1·43	0·76	0·32	1·02	1·20	2·56	1·15	17·0[illegible]
1915	2·15	0·45	0·96	1·93	3·51	2·55	2·56	0·50	0·73	1·32	0·87	3·00	20·5[illegible]
Means	2·91	1·00	0·67	1·12	1·53	1·89	1·80	1·11	1·03	0·98	2·44	1·82	18·30

During 1911-15 (1911 incomplete), average monthly snowfall was : Jan., 19·9 in , Feb , 5·4 ; Mar., 1·1 ; Apr[...]
1·2 ; Nov., 8·1 ; Dec., 16·1. Mean annual snowfall, 51·8 in.; maximum recorded, 31·5 in , Jan., 1913.

SALT SPRING ISLAND (VESUVIUS BAY)—Elevation, near sea-level

226

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	.....	.....	.....	3·98	2·41	2·00	1·31	0·20	2·75	4·17	13·61	5·30	.....
1894	7·42	3·75	5·07	3·83	3·00	2·25	2·80	0·11	2·68	3·97	5·18	4·03	44·10
1895	7·86	2·28	3·15	2·39	2·11	0·43	0·22	0·15	1·09	0·10	2·73	10·51	33·02
1896	9·67	4·83	1·69	1·08	1·66	0·92	0·30	0·51	1·00	2·54	9·29	8·58	42·07
1897	3·44	3·58	4·29	1·26	0·83	1·31	1·79	0·42	1·18	1·57	7·34	11·52	38·53
1898	2·37	6·89	0·82	1·33	1·71	1·54	0·23	0·33	2·60	3·29	6·86	4·18	32·21
1899	6·38	4·63	2·27	1·55	2·04	0·09	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1909	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12·01	3·99	.....
1910	5·23	5·76	2·07	1·47	0·85	1·34	0·00	0·82	1·41	4·36	9·93	7·45	40·60
1911	5·30	.....	.....	.....	.....	.....	.....	.....	.....	0·50	5·75	4·63	.....
1912	5·67	4·11	0·83	1·89	1·78	1·60	0·42	2·95	1·92	4·36	7·21	7·23	39·97
1913	5·71	1·91	2·42	1·32	2·24	1·67	1·33	1·09	2·08	3·54	8·50	2·52	34·33
1914	1[illegible]·45	2·75	2·18	3·07	0·36	2·21	0·12	0·26	3·40	5·50	8·69	1·77	43·76
1915	3·82	2·86	2·26	2·67	2·24	0·41	0·48	0·05	0·60	5·08	6·72	9·40	36·5[illegible]
Means	6·36	3·94	2·46	2·15	1·77	1·31	0·84	0·62	1·80	3·25	7·99	6·24	38·82

During 1893-1915 (1900-08 no records), average monthly snowfall was : Jan., 9·2 in.; Feb., 3·5 ; Mar., 2·5 [...]
Nov., 3·3 ; Dec., 2·2. Mean annual snowfall, 21·0 in.; maximum recorded, 23·5 in., Nov., 1911.

SANDSPIT (NEAR SKIDEGATE) Elevation, near sea level

227

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1905	.....	.....	.....	.....	.....	0·41	0·31	3·81	.....	.....	.....	.....	.....

SANDWICK—Elevation, near sea-level

228

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	2·13	11·41	3·74	.....
1915	6·84	5·47	4·07	1·79	1·91	0·27	0·79	0·89	1·24	9·43	7·71	12·64	53·05

Snowfall in Nov., 1914, 7·0 in., Dec., 3·0. In Jan., 1915, 2·0 ; Dec., 4·0 ; total in 1915, 6·0 in.

SATURNA ISLAND—Elevation, 14 ft.

229

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	.....	.....	.....	0·89	2·08	1·53	0·29	0·00	1·31	2·97	5·38	4·08	.....
1902	4·73	4·64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Snowfall in Jan., 1902, 13·0 in.

SEYMOUR INTAKE—Elevation, 465 ft.

230

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	2·01	8·23	11·34	23·88	10·39	.....
1914	24·29	9·37	11·09	6·79	3·50	4·04	0·68	1·27	11·22	15·90	22·39	4·58	100·81
1915	13·85	10·05	9·05	7·53	5·77	1·60	1·33	0·98	1·21	21·94	11·05	18·92	103·28

Snowfall in Nov., 1913, 3·0 in. In Jan., 1914, 13·2 ; Feb., 4·2 ; Mar., 9·0 ; Nov., 3·7 ; total in 1914, 30·1.
In Nov., 1915, 0·7 ; Dec., 17·5 ; total in 1915, 18·2 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

SHAWNIGAN LAKE—Elevation, 383 ft.

231

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911					2·38	0·72	0·22	0·60	1·74	1·31	7·76	4·83	......
1912	7·60	5·42	1·25	2·09	2·11	1·53	0·75	2·39	1·69	3·88	8·30	7·86	44·87
1913	7·74	1·85	2·67	1·09	1·68	2·08	0·92	1·02	1·98	3·03	10·10	2·44	36·60
1914	13·29	2·42	2·94	2·31	0·88	2·61	0·11	0·10	3·16	5·18	8·22	1·75	42·97
1915	2·23	2·07	1·94	1·57	1·79	0·88	0·73	0·08	0·71	3·77	8·27	10·57	34·61

Snowfall in Nov., 1911, 30·0 in.; Dec., 7·0. In Jan., 1912, 15·0; Dec., 5·0; total in 1912, 20·0. In Jan., 1913, 51·0; Feb., 2·0; Mar., 1·5; Dec., 5·0; total in 1913, 55·0. In Jan., 1914, 9·0; Mar., 0·3; Nov., 1·2; Dec., 3·0; total in 1914, 13·5. Total in 1915, 3·0 in., all in Dec.

SHUSWAP FALLS—Elevation, 1,600 ft.

232

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	1·56	1·14	0·07	1·07	1·18	2·96	3·40	2·01	1·16	1·37	1·79	1·42	19·33
1913	2·17	0·90	1·04	0·54	2·30	5·05	1·15	1·81	1·33	1·81	1·45	0·65	20·20
1914	1·66	1·28	0·55	1·01	1·29	2·25	1·96	0·48	2·46	1·64	1·58	0·58	16·74

Snowfall in Jan., 1912, 25·50 in.; Feb., 0·13; Nov., 2·25; Dec., 14·25; total in 1912, 42·13. In Jan., 1913 29·12; Feb., 7·38; Mar., 8·00; Oct., 0·75; Nov., 6·88; Dec., 9·13; total in 1913, 61·26 in.

SIDNEY—Elevation, 200 ft.

233

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914			1·28	1·63	0·28	2·14	0·13	0·13	1·97	3·63	7·98	1·21	......
1915	2·77	1·66	1·65	1·65	2·06	0·74	1·30	0·03	0·76	4·17	4·82	6·89	28·50

In 1914 a trace of snow fell in Nov. and Dec.

SKEENA RIVER (AT MOUTH FALLS R., Trib. to Hocsall River)—Elevation, near sea-level

234

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912			2·27	9·27	3·34	3·73	1·64	4·11	10·05	17·41	18·30	22·06	......
1913	18·02	6·20	......	......	......	......	......	......	......	......	......	......	......

SKEENA RIVER (AT KHATADA RIVER)—Elevation, near sea level

235

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911												11·69[1]	......
1912	5·12	6·39	1·81	6·74	1·89	3·42	2·65	3·30	7·02	10·66	12·67	4·04[2]	......

[1] Dec. 7 to Dec. 31. [2] Dec. 1 to Dec. 6.

SKIDEGATE—Elevation, near sea-level

236

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909											7·03	4·07	......
1910	7·83	4·96	7·01	8·99	2·88	1·86	1·02	1·28	......	9·52	10·06	10·17	......
1911	7·18	3·51	4·60	4·18	1·24	1·69	1·93	......	......	......	......	......	......

Snowfall in Nov., 1909, 2·0 in.; Dec., 18·0. In Jan., 1910, 7·0; Feb., 4·0; Mar., 5·0; Nov., 1·7; Dec., 4·2. In Jan., 1911, 43·0; Feb., 32·6; Mar., 0·0; April, 3·5 in.

SODA CREEK—Elevation, 1,690 ft.

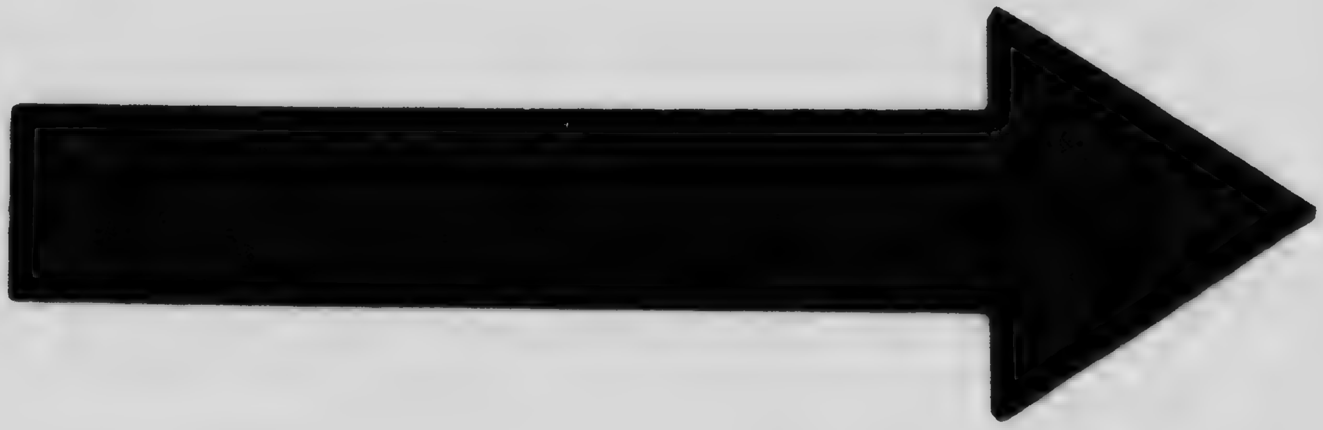
237

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1879	1·67	0·70	1·10	T	1·68	1·95	2·13	0·90	0·50	0·50	0·00	......	......
1882	......	......	......	......	0·45	0·55	0·37	......	0·37	0·30	0·10	0·90	......
1883	0·43	2·15	0·00	0·00	0·20	3·25	0·00	0·62	0·57	0·70	0·87	0·45	9·24
1884	0·85	0·00	T	0·00	0·17	0·48	0·55	0·20	0·50	0·35	0·88	0·55	4·53
1885	0·05	0·67	0·00	0·00	0·25	0·75	0·52	0·13	0·33	0·00	0·00	0·73	3·43
1913	......	......	......	......	......	......	......	......	......	......	0·29*	0·56	......
1914	1·31	3·10	1·99	0·70	2·13	4·28	2·54	0·18	1·20	0·34	1·56	0·73	20·06
1915	0·35	0·17	1·31	1·08	3·07	2·50	1·85	0·18	0·61	0·50	0·30	0·80	12·72

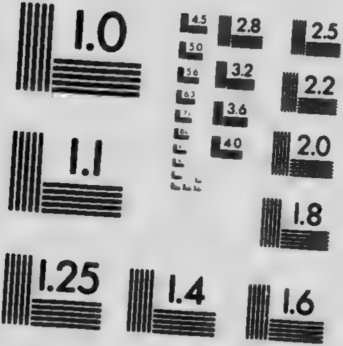
* In Nov., 1913, a new station was established by the Province. The earlier records are from the Dominion Meteorological Office

During 1879-1915 (1880, 1881 and 1886-1912 no record), average monthly snowfall was: Jan., 6·6 in.; Feb., 11·3; Mar., 2·2; Oct., 1·0; Nov., 4·2; Dec., 5·7. Mean annual snowfall, 31·0 in.; maximum recorded, 3·10 in., Feb., 1914.



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

SOOKE—Elevation, 25 ft.

TOTAL PRECIPITATION

238

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1903	10·42	4·23	4·68	2·83	1·70	2·10	0·92	1·56	5·75	5·08	15·15	6·65	61·07
1904	12·33	11·20	12·64	1·35	1·58	1·28	1·91	0·92	0·70	1·92	14·33	17·82	77·98
1905	9·00	6·01	9·84	1·10	5·40	2·54	1·75	1·43	7·15	7·14	4·03	4·71	60·10
1906	10·51	5·66	1·52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1910	7·06	5·58	4·50	2·30	0·90	1·00	0·00	0·20	1·60	6·40	11·20	9·70	[illegible]
1911	7·94	1·25	0·70	0·70	2·00	0·90	0·10	0·70	.....	.....	.....	.....	.....
1912	6·52	5·29	1·21	2·00	1·16	1·99	0·31	2·81	1·44	3·10	6·87	11·24	43·94
1913	8·81	3·29	3·17	1·28	1·49	2·15	0·86	0·45	3·11	6·92	9·94	2·47	43·94
1914	14·22	3·60	3·70	2·65	0·58	2·93	0·06	0·36	3·42	6·22	9·48	1·42	48·6·
1915	2·95	2·41	2·71	1·88	1·68	0·23	0·73	0·02	0·71	7·56	8·01	8·32	37·21
Means	8·98	4·85	4·47	1·79	1·83	1·68	0·74	0·94	2·98	5·54	9·88	7·79	51·47

During 1903-15 (1907-09 no record), average monthly snowfall was: Jan., 8·0 in.; Feb., 4·9; Mar., 5·0; Nov., 1·9; Dec., 1·4. Mean annual snowfall, 21·2 in.; maximum recorded, 31·5 in., Feb., 1904.

SOOKE LAKE—Elevation, 560 ft.

TOTAL PRECIPITATION

239

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	0·90	4·85	16·14	3·57	.....
1914	17·49	3·85	3·68	2·04	1·28	1·77	0·05	0·40	3·26	10·07	11·90	1·95	57·74
1915	4·23	3·80	3·85	2·23	2·12	0·50	1·39	0·06	0·37	12·80	10·53	14·90	56·78

Snowfall in Jan., 1914, 7·0 in.; Nov., 2·0; Dec., 1·0; total in 1914, 10·0. Total in 1915, 5·0 in., all in Dec.

SORRENTO—Elevation, 1,180 ft.

TOTAL PRECIPITATION

240

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	1·19	1·49	1·36	1·27	0·88	.....
1914	3·18	1·32	0·83	0·50	0·83	1·02	0·70	0·21	1·91	1·12	2·49	0·50	14·61
1915	1·47	0·51	0·86	0·83	3·08	4·46	3·40	0·68	1·20	1·29	0·67	2·49	20·94

Snowfall in Dec., 1913, 7·2 in. In Jan., 1914, 12·1; Feb., 9·3; Mar., 1·0; total in 1914, 22·4. In Jan., 1915, 11·2; Feb., 1·2; Nov., 4·5; Dec., 14·5; total in 1915, 31·4 in.

SPENCE BRIDGE—Elevation, 770 ft.

TOTAL PRECIPITATION

241

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1873	0·90	T	0·30	.....	.....	0·59	0·13	0·34	0·38	0·21	0·57	0·97	.....
1874	1·51	1·13	0·70	0·43	1·56	1·03	0·36	0·61	0·26	0·19	1·97	0·24	9·99
1875	1·45	0·09	1·49	0·26	0·23	0·97	2·25	1·18	0·45	0·62	1·46	1·39	11·84
1876	0·40	0·73	1·23	0·10	0·46	0·13	0·22	1·26	0·62	0·78	0·59	0·29	6·81
1877	0·65	1·68	0·51	0·38	1·41	0·75	1·25	1·07	2·37	0·01	1·12	0·76	11·96
1878	0·95	0·57	0·49	0·22	1·42	0·05	1·07	0·16	0·61	0·44	1·32	.....	.....
1879	0·75	2·35	2·68	0·24	0·59	1·50	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1882	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0·55	1·24	.....
1883	0·55	0·13	0·02	0·03	0·39	0·00	0·00	0·17	0·00	0·00	0·03	0·45	1·77
1884	.....	.....	0·27	0·10	0·40	0·93	0·63	0·43	0·82	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1888	.....	.....	.....	.....	.....	.....	.....	0·84	0·00	0·91	0·45	1·44	.....
1889	0·78	0·43	0·31	0·37	1·43	0·15	0·28	0·06	1·28	0·28	0·32	1·16	6·85
1890	1·99	1·09	0·45	0·26	1·43	1·85	0·78	0·79	0·24	0·37	0·83	2·79	12·87
1891	0·00	0·48	0·74	1·04	0·14	1·01	0·09	1·12	1·56	0·57	0·81	1·35	8·91
1892	0·85	0·00	0·15	0·18	0·42	0·55	0·17	0·22	0·52	1·03	2·56	1·50	8·15
1893	0·46	0·58	0·02	0·54	1·21	0·40	0·82	0·20	0·79	1·18	1·44	0·37	8·91
1894	2·22	0·34	0·15	0·21	2·22	1·88	0·40	0·30	2·76	1·23	1·25	0·58	13·54
1895	1·37	0·32	0·55	0·66	1·71	2·27	0·32	0·04	0·09	0·30	1·08	0·59	7·90
1896	1·48	0·95	0·27	0·66	0·26	0·01	0·00	0·03	0·04	0·02	1·62	0·19	5·53
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1901	0·28	0·15	0·07	0·44	0·02	0·70	T	.....	.....	.....	.....	.....	.....
1902	.....	.....	.....	.....	.....	.....	.....	0·02	.....	.....	.....	0·65	.....
1903	.....	.....	.....	0·01	.....	.....	.....	0·01	.....	.....	.....	.....	.....
1904	0·49	0·23	.....	.....	0·01	0·28	.....	.....	.....	.....	.....	.....	.....
1905	0·36	0·10	0·04	.....	0·97	0·61	0·79	.....	.....	.....	.....	.....	.....
1906	.....	0·38	T	0·03	.....	.....	0·22	.....	.....	.....	0·12	2·35	.....
1907	0·25	0·25	0·20	0·03	0·13	0·30	0·69	.....	.....	.....	0·63	0·38	.....
1908	0·43	0·72	0·20	0·30	.....	.....	0·09	.....	.....	.....	.....	1·20	.....
Means	0·86	0·58	0·53	0·31	0·82	0·67	0·50	0·47	0·78	0·51	0·98	0·99	8·00

During 1872-1908 (12 years complete), average monthly snowfall was: Jan., 5·1 in.; Feb., 3·9; Mar., 2·2; Nov., 5·0; Dec., 7·0. Mean annual snowfall, 23·2 in.; maximum recorded, 23·5 in., Feb., 1879.

STAVE LAKE, UPPER—Elevation, 250 ft.

TOTAL PRECIPITATION

242

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	.....	.....	.....	.....	.....	.....	3·63	0·97	3·89	15·92	14·71	26·28	.....

Snowfall in Dec., 1915, 22·5 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

STEELE—Elevation, 2,433 ft.

[illegible] TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	0·50	1·55	1·10	1·80	2·44	1·12	1·54	0·48	1·99	0·95	4·10	0·75	18·32
1894	1·80	0·47	0·66	1·47	2·24	2·11	0·30	1·56	1·90	1·13	1·50	1·16	16·30
1895	2·35	0·05	0·87	0·50	0·98	1·25	1·40	0·16	3·07	0·37	0·32	2·09	13·41
1896	1·86	0·31	0·67	0·83	0·89	1·09	0·83	2·20	0·72	0·19	2·76	1·23	13·58
1897	...	...	0·70	0·27	...	4·73	...	...	...	...	...	...	...
1913	...	...	...	...	...	...	...	...	...	...	1·96*	0·50	...
1914	2·54	0·45	1·80	1·64	0·96	2·07	0·80	0·49	1·36	1·83	2·49	0·75	17·18
1915	0·95	0·34	0·17	0·75	1·91	3·06	2·23	0·34	2·22	1·36	3·07	1·95	18·35

* In Nov., 1913, a new station was established by the Province. The record for 1893-1897 is from the Dominion observatory.

During 1893-1915 (complete record for 6 years), average monthly snowfall was: Jan., 11·7 in.; Feb., 4·9; Mar., 2·9; April, 1·2; Oct., 0·2; Nov., 14·0; Dec., 8·4. Mean annual snowfall, 43·3 in.; maximum recorded, 22·6 in., Nov., 1893.

STEVESTON (GARRY POINT)—Elevation, 6 ft.

243 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	...	4·42	1·28	3·11	1·83	1·45	0·00	0·23	0·92	3·59	7·98	7·85	...
1897	4·69	3·68	3·33	1·96	1·74	1·38	2·75	1·32	1·34	1·15	7·49	8·33	39·16
1898	3·75	5·69	1·49	1·64	2·03	3·84	0·32	0·15	2·74	2·87	6·36	2·36	33·24
1899	5·80	4·67	2·11	2·65	3·80	0·69	0·30	4·01	1·23	5·27	10·72	5·71	46·96
1900	5·12	4·47	6·79	3·25	2·43	3·68	1·01	2·38	1·46	4·23	6·39	6·41	47·62
1901	6·12	4·38	1·54	3·13	3·50	2·91	0·99	0·05	2·46	3·35	7·09	4·08	39·42
1902	4·50	6·31	4·11	2·05	2·64	1·63	1·47	0·78	2·43	2·63	5·67	5·62	39·82
1903	4·54	1·21	3·15	1·12	1·66	2·61	1·27	[illegible]	5·29	3·44	9·43	3·32	37·64
1904	8·05	6·21	4·61	2·22	1·33	1·36	1·78	[illegible]	1·93	2·41	6·15	8·08	44·79
1905	5·26	3·23	3·97	0·78	2·31	1·84	1·68	2·16	7·82	3·04	3·29	3·80	39·18
1906	5·70	3·43	2·03	0·65	2·75	1·77	0·24	[illegible]	6·79	4·88	5·85	5·72	49·36
1907	5·20	5·68	1·51	2·48	0·83	0·60	0·07	0·14	0·23	0·47	6·57	6·52	30·30
1908	4·96	3·99	1·52	1·35	2·88	1·34	0·73	0·56	0·80	3·72	9·29	5·24	36·38
1909	3·74	4·68	1·97	0·55	1·80	1·21	1·23	0·67	0·89	3·71	9·61	3·03	33·09
1910	6·59	3·02	2·08	1·92	1·73	1·47	0·01	0·46	1·12	6·08	7·47	6·17	38·12
1911	3·69	1·70	1·13	1·46	3·42	1·31	0·54	0·79	2·68	1·24	5·86	5·59	29·32
1912	5·52	3·30	0·41	2·42	2·25	1·49	1·62	4·46	1·99	4·17	6·25	5·43	39·31
1913	5·37	2·42	2·85	1·84	3·46	2·89	1·36	0·51	2·47	4·29	5·21	2·28	34·95
1914	8·41	2·10	1·44	2·46	0·53	2·44	0·13	0·37	3·69	4·41	6·17	2·59	34·65
1915	4·34	2·62	2·78	1·75	2·52	0·33	0·53	0·33	0·37	6·14	3·92	7·44	33·07
Means	5·33	3·86	2·50	1·94	2·27	1·81	0·90	1·06	2·43	3·55	6·83	5·27	37·75

During 1896-1915 (1896 incomplete), average monthly snowfall was: Jan., 8·6 in.; Feb., 2·8; Mar., 2·0; Nov., 1·8; Dec., 1·7. Mean annual snowfall, 16·9 in.; maximum recorded, 30·2 in., Jan., 1901.

STEWART—Elevation, 215 ft.

244 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	...	...	...	...	...	...	...	...	8·17	11·16	3·37	11·90	...
1911	8·64	3·99	8·71	5·61	2·21	2·21	3·01	3·67	3·24	6·23	8·70	11·71	67·93
1912	2·81	3·60	1·78	2·82	2·64	1·50	1·53	...	6·85	8·78	7·66	14·44	...
1913	6·00	3·56	6·31	...	2·58	1·78	5·43	6·69	10·87	10·68	8·82	11·62	...
1914	3·73	6·25	4·82	3·80	1·62	0·52	9·06	2·61	9·07	7·37	8·26	2·98	60·09
1915	6·00	3·38	2·87	5·02	1·71	2·21	1·96	...	...	...	5·82	9·06	...
Means	5·44	4·16	4·90	4·31	2·15	1·64	4·20	4·32	7·64	8·84	7·11	10·29	65·00

During 1910-15 (3 years complete), average monthly snowfall was: Jan., 42·8 in.; Feb., 27·8; Mar., 11·3; April, 7·4; Oct., 1·8; Nov., 29·0; Dec., 58·6. Mean annual snowfall, 178·7 in.; maximum recorded, 106·0 in., Dec., 1912.

STRATHCONA PARK—Elevation, 980 ft.

245 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	...	...	...	...	...	...	...	...	...	4·32	8·85	1·52	...
1914	10·20	7·79	6·54	3·67	0·76	1·72	0·22	0·95	3·90	8·52	13·11	...	...

Snowfall in Jan., 1914, 25·0 in.; Feb., 50·0; Mar., 32·0; Nov., 13·2 in.

SUGAR LAKE (HEAD OF*)—Elevation, 2,080 ft.

246 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	...	...	...	0·90†	1·31	2·58	2·97	3·47	2·04	3·16	[illegible]	3·54	...
1913	5·19	1·08	1·31	1·28	2·70	4·85	2·53	2·65	3·37	3·35	[illegible]	0·59	32·78

† April 19th to 30th.

Snowfall in Nov., 1912, 4·5 in.; Dec. [illegible]. In Jan., 1913, 62·6; Feb., 6·6; Mar., 15·2; Nov., 14·9; Dec., 7·5; total in 1913, 106·8 in.

* Records taken by the Couteau Power Co.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

SUMMERLAND—Elevation, 1,100 ft.

TOTAL PRECIPITATION

247

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	......	......	......	......	......	......	1·26	1·69	1·86	0·33	0·45	0·91	....
1908	0·44	1·22	0·57	0·43	2·02	0·27	0·88	0·97	0·36	0·51	0·16	0·73	8·56
1909	1·01	0·68	0·16	0·07	1·85	1·52	3·22	0·85	0·91	0·72	0·94	0·38	12·31
1910	0·52	1·00	0·14	0·51	0·95	1·01	0·27	0·82	0·33	0·51	1·60	1·17	8·83
1911	0·78	1·00	0·33	0·06	1·24	0·83	0·54	1·26	1·08	0·13	1·78	0·50	8·53
1912	1·52	0·86	0·08	1·61	1·11	1·60	1·53	2·14	1·34	1·33	1·15	0·55	13·82
1913	1·06	0·50	0·20	0·35	1·63	4·60	0·36	0·83	0·26	1·20	0·50	1·00	12·49
1914	1·91	0·57	0·34	1·02	1·17	1·32	0·25	0·12	2·24	0·78	0·92	0·82	11·46
1915	0·53	1·00	1·28	0·48	2·83	0·86	2·41	0·27	1·24	1·16	0·82	1·85	14·73
Means	0·97	0·85	0·39	0·57	1·60	1·50	1·19	0·99	1·07	0·74	0·92	0·88	11·67

During 1907-15 (1907 incomplete), average monthly snowfall was: Jan., 8·3 in.; Feb., 6·7; Mar., 0·3; Oct., 0·9; Nov., 3·7; Dec., 7·5. Mean annual snowfall, 27·4 in.; maximum recorded, 15·1 in., Jan., 1914.

SWANSON BAY—Elevation, near sea-level

TOTAL PRECIPITATION

248

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	......	......	......	......	1·42	3·61	3·67	7·86	6·75	18·15	34·89	21·98	....
1908	17·42	12·13	19·58	22·18	9·67	6·85	11·31	5·47	25·95	21·55	31·08	13·09	196·28
1909	14·22	14·41	13·75	7·24	8·91	6·59	12·02	25·21	25·40	32·19	23·22	6·05	189·21
1910	21·12	14·19	24·20	18·48	7·14	10·87	3·60	3·76	10·22	14·94	25·62	41·15	195·39
1911	27·57	7·48	26·20	8·01	5·37	8·82	4·04	3·28	8·71	25·77	27·53	28·04	180·82
1912	21·67	19·20	4·97	12·76	6·85	3·05	0·86	5·16	7·51	16·22	27·22	29·60	155·07
1913	12·07	10·22	18·02	20·27	12·74	3·95	......	......	......	......	......	......	....
Means	19·01	12·94	17·79	14·82	7·44	6·28	5·92	8·46	14·26	21·47	28·26	23·32	179·97

During 1907-13 (1908-12, complete), average monthly snowfall was: Jan., [illegible]·3 in.; Feb., 25·4; Mar., 11·8; April, 5·9; Oct., 0·7; Nov., 9·5; Dec., 10·7. Mean annual snowfall, 120·3 in.; maximum recorded, 130·5 in., Jan., 1911.

TAPPEN—Elevation, 1,350 ft.

TOTAL PRECIPITATION

249

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	4·11	0·88	0·74	0·36	1·09	3·20	1·95	1·49	1·86	1·72	2·00	0·89	20·29
1914	4·10	2·28	1·23	0·76	0·90	1·15	0·69	0·31	2·07	1·90	3·60	1·20	20·19
1915	2·51	0·76	1·01	1·34	3·55	3·92	2·75	0·60	1·22	1·34	1·96	3·23	24·19

During 1913-15, average monthly snowfall was: Jan., 30·9 in.; Feb., 9·8; Mar., 2·4; Nov., 9·4; Dec., 14·8. Mean annual snowfall, 67·3 in.; maximum, 41·1 in., Jan., 1913.

TERRACE—Elevation, 545 ft.

TOTAL PRECIPITATION

250

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	......	......	......	......	......	......	......	......	......	0·93	7·36	6·98	....
1913	3·66	1·26	3·14	2·01	1·81	1·89	1·72	1·60	5·23	7·04	6·14	11·87	47·37
1914	3·42	4·19	2·81	1·46	......	......	......	......	5·75	5·53	12·21	2·50	....
1915	1·78	2·36	3·03	3·15	2·19	2·00	1·47	1·09	2·94	4·82	4·50	5·44	34·77
Means	2·95	2·60	2·99	2·21	2·00	1·95	1·60	1·34	4·64	4·58	7·55	6·70	41·11

During 1912-15 (1912 incomplete), average monthly snowfall was: Jan., 12·6 in.; Feb., 13·3; Mar., 0·2; Nov., 3·7; Dec., 12·3. Mean annual snowfall, 42·1 in.; maximum recorded, 19·3 in., Jan., 1913.

TÊTE JAUNE—Elevation, 2,400 ft.

TOTAL PRECIPITATION

251

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	3·41	0·50	2·09	1·93	0·39	3·60	0·74	2·40	1·60	....
1915	1·40	0·43	0·00	1·08	1·71	1·67	2·86	0·63	1·38	2·66	0·94	1·08	15·84

Snowfall in Nov., 1914, 3·6 in.; Dec., 16·0. In Jan., 1915, 14·0; Feb., 1·8; Nov., 5·8; Dec., 8·0; total in 1915, 29·6 in.

THETIS ISLAND—Elevation, near sea-level

TOTAL PRECIPITATION

252

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	......	......	5·29	1·93	1·19	0·67	1·14	0·87	[illegible]	2·04	9·72	10·18	....
1905	7·32	4·14	3·92	0·63	2·02	1·98	0·49	0·97	6·33	3·43	3·13	5·10	39·46
1906	4·50	4·09	1·84	0·50	3·02	1·70	0·16	0·09	5·18	4·90	7·83	6·46	40·27
1907	4·75	4·72	1·53	1·53	0·82	1·30	......	......	......	......	......	8·04	....
1908	8·90	6·39	2·94	1·83	2·47	0·25	0·31	......	......	......	......	6·93	....
Means	6·37	4·83	3·10	1·28	1·90	1·18	0·52	0·64	4·02	3·46	6·89	7·34	41·53

Snowfall in Mar., 1904, 3·1 in.; Dec., 6·7. In Jan., 1905, 8·0; Feb., 2·0; total in 1905, 10·0. In Jan., 1906, 2·0; Dec., 3·0; total in 1906, 5·0. In Jan., 1907, 12·0; Feb., 6·0 in.

THRUMS—Elevation, 1,500 ft.

TOTAL PRECIPITATION

253

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	......	......	1·41	2·11	1·70	3·90	0·88	....
1914	6·21	2·82	2·87	2·92	1·89	2·67	0·68	0·33	3·36	2·08	3·90	1·37	31·10
1915	1·50	1·68	1·41	2·73	4·09	2·47	3·16	0·44	0·79	2·00	3·39	3·30	26·96

Snowfall in Nov., 1913, 8·1 in.; Dec., 5·5. In Jan., 1914, 12·7; Feb., 12·5; Mar., 9·0; Dec., 6·3; total in 1914, 40·5. In Jan., 1915, 15·0; Feb., 7·0; Nov., 15·5; Dec., 24·7; total in 1915, 62·2 in.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

254

TRANQUILLE—Elevation, 1,142 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1911	....	....	0·16	0·05	1·27	0·14	0·42	1·67	1·26	0·02	1·91	0·86	....
1912	0·75	0·26	0·00	1·22	0·47	0·70	2·36	2·31	0·68	0·18	0·14	....	....
1913	0·69	1·45	0·40	0·20	....	1·45	0·81	0·77	0·07	0·86	0·66	0·29	....
1914	1·48	2·57	0·21	0·14	1·28	0·44	0·75	0·05	1·03	0·49	0·84	0·49	9·68
1915	0·89	0·10	0·59	0·15	1·54	2·40	2·73	0·54	0·67	0·16	0·42	1·02	11·21
Means	0·95	1·10	0·27	0·35	1·14	1·03	1·41	1·07	0·74	0·34	0·79	0·64	9·83

During 1911-15 (1914 and 1915 complete), average monthly snowfall was: Jan., 6·5 in.; Feb., 8·0; Nov., 4·2; Dec., 6·0. Mean annual snowfall, 24·7 in.; maximum recorded, 23·5 in., Feb., 1914.

255

TRIANGLE ISLAND—Elevation, 680 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	....	....	....	....	1·86	3·03	2·26	2·40	5·42	10·75	15·93	11·95	....
1911	12·71	5·28	4·88	2·57	2·55	5·01	3·29	3·71	5·88	10·70	10·42	7·94	74·85
1912	5·93	7·22	0·73	4·02	3·64	0·97	0·95	2·85	3·26	11·26	9·62	9·16	59·61
1913	9·27	3·91	4·86	7·37	5·84	3·76	1·55	2·91	7·08	7·28	10·30	19·17	83·30
1914	7·14	4·33	4·27	4·44	0·25	0·09	2·63	0·71	1·15	1·97	3·07	3·64	33·69
1915	5·70	7·72	7·01	5·99	3·09	1·03	0·35	2·08	2·94	3·74	4·36	3·76	47·77
Means	8·15	5·69	4·35	4·88	2·87	2·65	1·82	2·44	4·29	7·62	8·93	9·27	63·04

During 1910-15 (1910 incomplete), average monthly snowfall was: Jan., 23·8 in.; Feb., 4·3; Mar., 0·3; April, 2·4; Nov., 1·0; Dec., 0·5. Mean annual snowfall, 32·3 in.; maximum recorded, 87·9 in., Jan., 1911.

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UCLUELET—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	....	....	....	....	....	2·75	0·13	0·50	8·26	29·51	23·45	8·24	....
1915	11·89	12·57	12·67	7·22	7·22	1·11	2·36	1·85	2·07	18·11	13·28	22·66	113·01

Snowfall in 1915, 8·0 in., all in Dec.

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UNION BAY*

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1893	....	....	....	....	....	....	....	....	....	....	....	9·20	....
1894	....	....	8·49	4·98	1·42	4·00	0·40	0·71	5·54	8·59	5·43	11·85	....
1895	9·63	8·84	9·02	6·89	3·56	1·42	1·09	0·09	2·56	0·33	6·47	15·57	65·47
1896	26·46	10·59	4·18	2·75	2·34	1·06	0·02	0·89	0·41	3·61	8·45	15·98	76·74
1897	7·37	3·71	7·30	2·73	0·60	2·48	2·71	2·33	1·98	6·01	10·60	12·96	60·75
1898	2·74	10·89	....	....	....	....	....	....	....	....	....	....	....

During 1893-98 (1895-97 complete), average monthly snowfall was: Jan., 30·6 in.; Feb., 10·4; Mar., 22·3; Nov., 10·5; Dec., 20·9. Mean annual snowfall, 94·7 in.; maximum recorded, 69·0 in.; Jan., 1896.

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VALDEZ ISLAND—Elevation, near sea-level

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	....	....	....	....	....	....	....	....	....	1·32	7·35	13·79	....
1896	17·05	8·29	2·58	3·30	2·66	2·87	0·02	0·59	0·13	4·42	6·72	12·71	61·34
1897	5·80	7·05	5·80	2·93	1·65	2·59	1·13	2·59	2·64	5·16	10·54	12·29	60·17
1898	6·69	10·63	2·54	2·24	3·32	3·53	1·07	0·09	3·54	2·98	10·77	5·12	52·52
1899	6·62	7·74	2·72	3·76	....	....	....	....	....	....	....	....	....
Means	9·04	8·43	3·41	3·06	2·54	2·99	0·74	1·09	2·10	3·47	8·84	11·01	56·72

During 1895-99 (1896-98 complete), average monthly snowfall was: Jan., 13·8 in.; Feb., 15·8; Mar., 3·6; Nov., 6·6; Dec., 8·1. Mean annual snowfall, 47·9 in.; maximum recorded, 39·5 in., Jan., 1896.

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VANCOUVER—Elevation, 136 ft.

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1898	....	....	....	....	....	....	....	....	....	4·48	9·74	....	....
1899	10·59	6·04	3·01	4·29	3·92	....	0·32	....	....	....	....	....	....
1900	7·24	5·95	10·29	4·51	4·20	5·42	1·05	3·60	1·61	9·20	10·00	9·22	72·29
1901	11·28	6·31	3·04	5·29	4·38	5·01	0·83	0·22	2·65	5·20	14·06	8·09	66·36
1902	6·08	10·17	7·45	3·11	4·40	1·97	2·37	1·15	3·39	4·72	10·33	9·55	64·69
1903	7·70	2·60	5·78	3·78	3·68	3·56	1·12	1·07	8·35	5·72	11·36	4·21	58·93
1904	8·79	8·90	....	....	....	....	....	....	....	....	....	....	....
1905	....	....	....	1·21	2·20	2·53	1·99	2·09	9·09	4·98	4·26	6·71	....
1906	9·66	6·03	2·37	1·04	3·58	3·04	0·45	0·83	8·87	7·60	8·25	7·33	59·05
1907	9·32	8·30	2·39	4·13	1·44	1·43	1·70	1·36	4·51	1·76	13·23	8·02	57·59
1908	7·60	6·30	7·14	2·61	4·11	1·86	1·59	1·15	1·46	6·77	18·99	8·41	67·99
1909	6·21	8·15	4·31	1·30	3·76	1·69	2·45	1·43	2·23	7·06	15·66	4·29	58·54
1910	11·19	5·01	2·91	3·60	2·15	1·98	0·24	1·38	2·47	9·04	10·62	8·79	59·38
1911	6·11	3·37	3·05	1·96	5·39	2·09	0·92	1·23	4·41	2·24	12·68	8·82	52·27
1912	8·46	6·25	0·89	3·92	2·35	2·28	1·54	5·86	2·84	4·64	9·21	8·80	57·04
1913	9·62	4·28	5·37	2·53	4·33	3·81	2·02	0·85	3·89	6·19	10·08	3·95	56·92
1914	10·56	4·87	3·33	3·28	0·74	3·58	0·42	0·75	6·86	6·37	10·18	2·84	53·78
1915	7·13	4·42	4·18	3·04	3·42	1·07	0·91	0·36	0·80	8·83	5·41	10·66	50·23
Means	8·60	6·06	4·37	3·10	3·38	2·75	1·25	1·56	4·23	5·93	10·88	7·31	59·42

During 1898-1915 (14 years complete), average monthly snowfall was: Jan., 13·0 in.; Feb., 3·1; Mar., 1·6; Nov., 2·7; Dec., 2·6. Mean annual snowfall, 23·0 in.; maximum recorded, 57·3 in., Jan., 1913.

* Observer moved from Union Bay to Cumberland in 1898. For supplementary record see under Cumberland.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

VANCOUVER (CITY HALL)—Elevation, 40 ft.

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Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	......	......	4·85	1·97	0·63	3·37	5·82	10·63	4·26	......
1914	11·18	4·41	3·32	3·46	0·95	3·29	0·48	0·85	7·10	6·59	10·19	2·56	54·38
1915	7·34	4·61	4·21	3·18	3·71	0·96	0·81	0·31	0·87	5·25	9·66	10·82	51·73

VANCOUVER (COURT HOUSE)

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Station started recording January, 1916.

VAVENBY—Elevation, 1,538 ft.

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Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	......	0·44	0·59	1·56	1·67	2·15	1·74	1·50	1·29	0·33	......
1914	1·93	0·79	0·97	0·37	0·86	1·65	1·87	0·33	1·94	0·86	1·93	1·04	14·54
1915	0·41	0·20	0·33	0·72	1·49	3·11	3·45	0·81	1·53	1·12	0·60	1·27	15·04

Snowfall in Nov., 1913, 4·6 in.; Dec., 3·2. In Jan., 1914, 10·4 ; Feb., 7·5 ; Mar., 2·0 ; Nov., 8·5 ; Dec., 9·8 ; total in 1914, 38·2. In Jan., 1915, 1·5 ; Nov., 4·5 ; Dec., 6·3 ; total in 1915, 12 3 in.

VERNON—Elevation, 1,575 ft.

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Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	......	......	......	......	......	0·49	1·40	0·12	2·97	0·06	1·65	1·43	......
1896	0·75	1·15	0·00	0·70	1·52	0·66	0·00	0·45	0·31	1·28	1·47	4·15	12·44
1897	0·90	1·25	......	......	......	1·98	2·21	1·70	0·81	0·32	1·95	1·70	......
1898	2·15	0·78	0·02	0·03	1·48	1·75	0·90	0·00	1·25	0·45	0·85	0·00	9·66
1899	0·15	1·40	......	......	......	......	......	......	......	......	......	......	......
1900	......	......	......	......	......	......	......	......	......	......	......	......	......
1901	0·75	0·59	0·19	1·01	0·55	1·45	0·50	0·12	1·27	0·10	......	......	......
1902	0·80	......	......	......	......	1·96	2·45	1·51	1·51	0·00	2·31	0·70	......
1903	1·60	0·00	2·50	0·50	0·56	2·77	3·96	2·07	2·08	0·55	1·27	0·10	17·96
1904	0·60	2·80	0·60	0·11	0·46	1·43	0·42	0·27	0·02	0·85	0·14	0·80	8·50
1905	T	0·25	0·59	0·40	2·33	2·64	0·34	0·30	3·27	1·52	1·15	0·20	12·99
1906	0·95	1·25	1·01	0·35	2·25	2·19	0·31	0·23	0·90	1·12	2·61	1·70	14·87
1907	2·25	1·35	1·90	0·50	1·55	1·56	0·93	3·52	2·67	0·34	1·24	0·80	18·61
1908	1·05	1·30	0·57	0·63	0·74	0·93	0·58	1·40	0·87	0·76	0·25	0·86	9·94
1909	0·85	0·85	0·17	0·42	0·88	1·76	2·92	0·77	1·90	1·38	1·36	0·80	14·06
1910	0·65	2·10	0·80	0·40	0·77	1·75	0·98	1·65	0·71	1·88	1·24	2·33	15·26
1911	1·40	0·90	0·75	0·46	1·73	1·75	1·32	1·42	0·91	0·07	4·07	2·55	17·33
1912	2·38	0·92	......	1·10	0·80	1·32	2·57	1·19	0·70	1·20	1·38	1·20	......
1913	2·45	1·02	0·34	0·67	1·56	4·17	1·26	0·86	1·33	1·61	0·99	0·40	16·66
1914	1·25	1·22	0·51	0·42	1·07	1·05	0·62	0·53	1·96	1·15	1·46	1·15	12·42
1915	1·33	0·56	0·68	1·63	2·91	1·73	2·18	0·72	0·92	1·14	0·88	0·87	15·55
Means	1·17	1·09	0·71	0·58	1·32	1·76	1·36	0·90	1·39	0·83	2·07	1·21	14·48

During 1895-1915 (14 years complete), average monthly snowfall was : Jan., 11·2 in.; Feb., 9·3 ; Mar., 3·7 ; April, 0·6 ; Nov., 7·5 ; Dec., 9·9. Mean annual snowfall, 42·4 in.; maximum recorded, 28·0 in., Feb., 1904.

VICTORIA AND ESQUIMALT*—Elevation, near sea-level

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Total Precipitation

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1875	2·90	0·83	4·95	1·11	2·42	0·73	0·00	0·82	0·80	4·48	7·57	9·65	36·26
1876	2·39	5·06	3·04	0·88	0·76	0·83	0·40	0·41	1·15	2·54	4·27	1·84	23·57
1877	3·35	2·25	3·46	0·14	0·58	0·65	0·22	0·23	2·53	3·13	6·64	2·77	25·95
1878	1·68	2·79	1·84	0·54	0·87	0·14	0·36	0·07	0·91	3·02	4·71	3·97	20·90
1879	3·63	2·98	4·65	0·54	1·50	0·74	0·77	......	......	......	......	......	......
1880	8·00	2·00	1·83	1·14	0·74	0·65	0·88	0·45	0·82	2·83	1·94	8·58	29·56
1881	3·84	8·84	1·57	2·70	1·48	1·56	0·90	0·79	0·82	4·11	5·25	6·13	37·99
1882	2·28	3·55	4·02	1·24	0·53	0·42	1·24	0·99	0·59	4·30	3·32	5·37	27·85
1883	5·67	3·26	1·56	2·02	0·74	0·53	0·06	0·00	1·65	1·58	6·03	4·55	27·65
1884	5·25	2·11	0·38	1·02	0·73	1·59	0·48	1·84	1·66	4·88	1·60	1·95	23·49
1885	9·95	3·84	0·32	0·53	1·30	0·25	0·06	0·02	4·00	2·73	3·47	2·47	28·94
1886	3·84	3·17	2·94	1·67	0·45	1·00	0·80	0·73	1·59	2·32	1·92	7·16	27·59
1887	6·58	5·36	5·36	0·76	1·32	0·48	0·27	0·01	1·16	2·75	5·36	9·18	38·59
1888	5·02	1·77	3·53	2·26	0·19	2·23	0·34	0·42	1·01	3·35	3·69	1·96	25·77
1889	2·84	1·12	1·50	1·83	1·01	0·77	0·00	1·04	2·33	2·08	1·76	2·28	18·56
1890	3·96	2·33	1·50	0·86	0·98	2·10	0·64	0·12	0·33	7·52	1·74	8·28	30·36
1891	5·22	2·62	3·42	2·72	0·76	1·26	0·02	1·47	4·27	2·04	7·22	12·58	43·63
1892	5·29	0·80	3·05	2·53	1·95	0·60	0·87	0·72	4·09	1·56	10·34	4·75	36·65
1893	4·55	6·12	3·36	5·37	2·35	1·73	0·95	0·06	1·21	4·61	10·43	9·75	50·49
1894	7·31	4·33	4·59	4·23	2·71	2·37	0·21	0·25	3·63	4·60	6·88	1·66	42·77
1895	6·84	2·62	1·52	2·02	1·60	0·48	0·12	0·45	1·32	0·45	3·43	12·18	33·03
1896	8·24	6·80	1·71	1·08	1·62	0·69	T	0·57	1·52	2·87	11·02	10·41	46·53
1897	5·99	3·91	4·83	1·04	0·62	0·86	0·97	0·29	1·80	1·26	7·29	10·84	39·70
1898	2·78	5·19	1·66	0·88	0·60	1·82	0·28	0·27	1·79	3·14	4·44	4·11	26·96
1899	5·00	5·36	2·45	2·88	1·50	0·68	0·18	1·28	0·72	3·38	6·43	5·28	35·14
1900	3·58	2·75	3·63	0·87	1·04	1·61	0·40	0·61	1·15	2·68	2·31	4·07	24·70
1901	4·15	3·37	0·93	3·01	0·98	1·06	0·19	0·00	0·90	1·55	6·44	3·46	26·14
1902	3·13	2·47	2·27	0·95	0·97	0·08	0·37	0·43	2·31	1·09	6·15	6·23	26·45
1903	3·94	1·31	2·71	1·39	0·76	0·67	0·46	0·86	3·76	1·76	5·99	2·41	26·02
1904	4·32	3·93	3·62	0·75	0·49	1·29	0·48	0·50	0·32	0·88	5·23	4·71	26·52

* See footnote, page 567.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

VICTORIA AND ESQUIMALT*—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1905	3·34	2·27	1·39	0·21	2·81	1·06	0·10	1·21	4·03	2·81	0·91	2·82	22·96
1906	2·56	1·66	0·67	0·46	1·81	0·65	0·16	0·53	3·14	5·60	6·13	3·85	27·22
1907	3·04	3·94	1·40	1·39	0·35	0·33	0·39	0·23	1·21	0·73	4·68	4·78	22·47
1908	3·22	4·32	4·58	0·63	1·27	0·09	0·15	0·67	0·62	2·33	4·02	4·88	26·78
1909	3·25	2·20	0·73	0·61	0·96	0·47	0·92	0·47	0·79	2·31	11·51	3·77	27·99
1910	4·55	4·73	2·37	1·70	0·77	0·96	0·01	0·36	1·39	5·09	7·71	6·41	36·25
1911	4·30	0·96	1·93	0·59	1·80	0·73	0·14	0·68	2·25	0·61	7·40	2·80	24·19
1912	4·15	3·14	1·43	1·30	1·56	0·99	1·15	2·26	0·66	2·33	5·04	5·84	29·85
1913	4·54	1·91	2·00	0·62	0·80	1·05	0·45	0·84	1·95	3·63	4·70	1·35	23·84
1914	8·47	1·56	2·05	1·04	0·18	1·67	T	0·18	1·98	2·58	5·83	0·59	26·13
1915	1·55	0·98	1·53	0·57	1·26	0·61	0·84	0·04	0·80	4·20	4·57	4·80	21·75
Means	4·50	3·18	2·49	1·42	1·15	0·94	0·42	0·58	1·73	2·89	5·38	5·26	29·94

During 1875-1915 (39 years complete), average monthly snowfall was: Jan., 5·0 in.; Feb., 2·9; Mar., 0·9; Nov., 0·9; Dec., 0·7. Mean annual snowfall, 10·4 in.; maximum recorded, 37·0 in., Feb., 1893.

VICTORIA WATER WORKS (BEAVER LAKE—ROYAL OAK)

265 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	5·37	2·50	1·66	2·03	1·60	0·45	0·26	0·29	1·08	0·42	2·43	12·95	31·04
1896	5·93	6·47	1·79	1·39	1·20	0·86	0·10	0·29	1·15	2·76	11·82	10·24	44·00
1897	4·61	1·19	5·70	1·29	0·52	0·98	1·32	0·44	1·44	1·32	7·11	11·52	40·44
1898	2·46	5·05	2·06	0·93	0·80	1·71	0·29	0·23	1·86	3·37	5·93	4·65	29·34
1899	5·68	5·37	2·03	3·22	2·24	0·37	0·10	1·89	0·95	3·89	9·33	7·14	42·21
1900	5·04	3·32	5·41	1·40	1·45	2·78	0·62	0·36	1·45	4·48	3·65	5·51	35·47
1901	6·90	4·92	2·54	3·37	1·46	0·87	0·45	0·05	1·16	3·28	8·55	5·11	38·66
1902	4·39	3·94	3·43	1·60	1·17	0·30	0·82	0·68	2·79	2·15	8·86	10·02	40·15
1903	5·14	2·90	3·12	1·71	0·92	1·08	0·51	0·51	3·83	3·51	7·93	3·09	34·28
1904	6·52	6·41	4·81	0·94	0·76	1·32	0·71	0·42	0·45	1·62	7·69	8·01	39·69
1905	5·43	3·23	2·34	0·63	3·86	1·28	0·09	1·16	5·08	3·83	1·62	4·52	33·07
1906	4·56	2·77	0·83	0·51	2·10	1·02	0·17	1·20	3·51	5·34	7·61	5·85	35·48
1907	4·28	3·49	1·81	1·89	0·52	0·38	0·39	0·35	1·19	0·93	5·69	7·33	28·10
1908	5·03	5·69	5·20	0·88	1·61	0·30	0·16	0·83	0·64	2·79	4·43	7·62	35·18
1909	6·46	3·74	1·31	0·83	1·36	0·63	1·24	0·68	0·64	2·64	14·07	3·89	37·49
1910	6·06	5·94	1·61	1·10	0·75	1·12	0·06	0·38	1·32	5·31	8·85	6·09	38·59
1911	5·55	1·02	1·62	0·81	2·25	0·77	0·05	0·70	2·03	0·77	6·02	3·19	24·78
1912	5·74	3·99	1·32	1·43	1·48	1·22	0·70	2·57	1·02	1·91	5·26	5·32	31·96
1913	6·12	2·30	2·23	0·74	0·74	1·30	0·84	0·72	1·91	3·15	6·32	1·67	28·04
1914	9·27	2·34	1·80	1·34	0·47	2·04	0·05	0·17	2·46	2·49	6·40	0·86	[illegible]
1915	2·13	1·17	2·08	0·68	1·65	0·52	1·10	0·35	0·37	4·75	5·66	7·35	27·81
Means	5·37	3·85	2·60	1·37	1·38	1·01	0·47	0·68	1·73	2·89	6·91	6·28	34·54

During 1895-1915, average monthly snowfall was: Jan., 5·9 in.; Feb., 1·9; Mar., 1·7; Nov., 1·6; Dec., 1·7. Mean annual snowfall, 12·8 in.; maximum, 18·0 in., Mar., 1897.

WANETA (PEND-D'OREILLE)—Elevation, 2,260 ft.

266 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	......	......	2·04	0·34	2·51	6·19	3·58	0·99	1·60	1·71	5·12	0·43	....
1914	5·01	1·20	2·36	2·33	2·87	3·36	1·36	0·00	3·93	1·33	2·99	1·43	28·17
1915	1·20	1·50	2·07	2·50	4·85	3·03	4·26	0·10	0·89	2·38	3·25	3·55	29·49

During 1913-15 (1913 incomplete), average monthly snowfall was: Jan., 24·8 in.; Feb., 11·0; Mar., 7·0; April, 0·3; May, 1·0; Oct., 3·4; Nov., 19·0; Dec., 14·2. Mean annual snowfall, 80·7 in.; maximum recorded, 37·5 in., Jan., 1914.

WELCOME HARBOUR (PORCHER ISLAND)—Elevation, near sea-level

267 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	......	......	......	......	1·51	......	......	......	......	......	......	....
1915	Obser	ver to	war.	Some	return	s later.	......	......	......	7·73	13·38	11·80	....

Snowfall in Dec., 1915, 2·0 in.

WESTLEY—Elevation, 1,414 ft.

268 TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	......	1·26	2·12	2·72	1·78	2·13	1·48	0·32	2·71	1·45	3·21	1·42	....
1915	1·34	1·25	1·02	1·82	4·65	2·80	3·43	0·17	0·67	1·91	2·39	3·87	253·2

Snowfall in Feb., 9·5 in.; Mar., 7·5; Dec., 14·2. In Jan., 1915, 9·9 in.; Feb., 1·8; Nov., 15·3; Dec., 22·8; total in 1915, 49·8 in.

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* Observations at Victoria and Esquimalt:

(1) W. T. Bevis, light keeper at Fisgard lighthouse, E[illegible]uimalt harbour, kept some records from Jan. 1, 1872, to July 31, 1890.

(2) W. T. Livock, Chief Factor, Hudson's Bay Co., ke[illegible] records at Victoria from Dec. 1, 1877, to July 31, 1890. Private records from Dec., 1877, to Dec. 31, 1884. Meteo[illegible]ogical Service of Canada from Jan. 1, 1885, to July 31, 1890.

(3) E. Baynes Reed, appointed meteorological observ[illegible]r to succeed Mr. Livock. Station at Esquimalt from Aug. 1, 1890, to Aug. 9, 1898. Station at Mr. Reed's residence, Cook street, Aug. 10, 1898, to Dec. 13, 1899. Post Office building, Dec. 13, 1899. Thermometer shed moved to back of Post Office in 1905. Station moved to present ite on Gonzales Hill, April 22, 1914.

PRECIPITATION RECORDS FOR STATIONS IN BRITISH COLUMBIA—*Continued*

WHITE LAKE

269 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1895	0·83	0·33	0·38	3·06	0·22	0·03	.....	.....	.....	.....	.....	.....	.....

Snowfall in Jan., 1895, 7·7 in.; Feb., 3·3 , Mar., 3·2 in.

WILMER—Elevation, 3,300 ft.

270 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1909	.....	.....	.....	.....	.....	.....	.....	.....	1·15	0·45	1·76	0·45	.....
1910	T	0·75	0·05	0·67	0·55	1·61	0·36	.....	.....	0·79	0·69	0·69	.....
1911	2·09	0·44	0·45	0·35	.....	1·91	0·70	1·67	0·13	0·37	1·10	0·32	.....
1912	0·73	0·13	.....	0·35	1·12	1·67	3·95	1·52	1·35	0·74	0·95	0·50	.....
1913	1·28	0·35	0·85	0·44	0·79	1·57	2·24	2·04	1·78	0·42	1·13	0·35	13·24
1914	2·18	0·48	0·94	1·30	1·32	1·51	1·96	0·82	2·54	0·88	1·23	0·53	15·69
1915	0·85	0·48	0·08	0·45	1·63	4·02	4·12	0·51	0·91	0·80	1·01	0·80	15·66
Means	1·19	0·44	0·47	0·59	1·08	2·05	2·22	1·32	1·31	0·64	1·12	0·52	12·95

During 1909-15 (1913-15 complete), average monthly snowfall was: Jan., 9·9 in.; Feb., 4·4; Mar., 3·4; April, 0·3; Sept., 0·3; Nov., 7·6; Dec., 5·2. Mean annual snowfall, 31·1 in.; maximum recorded, 20·9 in., Jan., 1911.

WOLF CREEK (WASA)—Elevation, 2,550 ft.

271 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1913	.....	.....	.....	.....	.....	.....	.....	.....	0·70	0·34	1·50	1·00	.....
1914	3·51	1·00	1·64	0·82	1·09	1·63	1·38	0·18*	.....	.....	.....	.....	.....
1915	.....	.....	.....	0·32	2·05	2·95	0·75	0·35	1·87	1·20	2·90	3·10	.....

* Observer died; station re-established in March, 1915

Snowfall in Nov., 1913, 13·0 in.; Dec., 10·0. In Jan., 1914, 30·0; Feb., 10·0; Mar., 12·0. In Nov., 1915, 27·0; Dec., 31·0 in.

WYCLIFFE—Elevation, 2,800 ft.

272 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	.....	.....	.....	0·60	0·81	1·66	2·42	0·57	0·60	1·91	2·26	2·35	.....
1913	.....	1·40	4·27	1·43	0·66	2·01	1·01	1·40	0·37	0·05	1·00	0·70	.....
1914	2·50	0·96	0·02	0·39	0·89	1·44	0·95	0·00	0·06	0·17	0·05	.....	.....
1915	Obser	ver to	war.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	2·50	1·18	2·15	0·81	0·72	1·70	1·46	0·66	0·34	0·71	1·10	1·52	14·85

Snowfall in Oct., 1912, 6·8 in.; Nov., 16·0; Dec., 11·8. In Feb., 1913, 14·0; Mar., 24·0; Nov., 10·0; Dec., 7·0. In Jan., 1914, 25·0 in.; Feb., 9·5; Mar., 0·1 in.

PRECIPITATION RECORDS FOR SELECTED STATIONS IN ALBERTA

ATHABASKA—Elevation, 1,690 ft.

273 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1900	.....	.....	.....	2·27	2·63	4·55	3·51	2·91	3·51	0·67	0·25	0·40	.....
1901	.....	.....	0·67	0·50	1·63	.....	.....	.....	2·27	0·00	0·73	0·45	.....
1902	0·26	0·31	0·43	T	3·78	1·89	3·23	1·35	T	0·63	1·04	.....	.....
1903	0·00	0·25	0·37	0·80	.....	.....	.....	.....	.....	.....	.....	.....	.....
1904	.....	.....	.....	.....	.....	2·17	1·17	0·89	1·22	1·40	0·10	T	.....
1905	.....	0·15	0·02	.....	0·73	2·37	3·66	1·63	0·25	0·39	0·25	0·05	.....
1906	0·12	0·45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1908	.....	.....	.....	.....	.....	.....	.....	.....	0·60	1·20	0·67	0·85	.....
1909	0·85	0·20	0·70	1·30	3·24	2·52	2·11	1·01	0·07	0·57	2·05	0·60	15·22
1910	.....	0·55	0·02	0·39	1·12	3·04	4·82	2·11	1·85	1·41	0·50	1·04	.....
1911	0·92	0·48	1·16	0·34	1·87	5·48	2·30	2·02	1·38	0·38	0·50	0·20	17·03
1912	0·65	0·26	0·50	1·40	0·72	1·72	2·65	2·56	0·72	0·74	0·23	0·54	12·69
1913	1·33	0·40	0·49	0·92	0·79	4·82	6·81	2·64	0·60	0·68	0·25	0·10	19·83
1914	0·53	0·13	0·66	0·44	0·17	7·05	2·82	1·31	1·63	1·63	0·28	1·07	17·72
1915	0·45	0·20	0·05	1·83	1·98	2·46	2·44	0·81	1·38	0·39	0·35	0·60	12·94
Means	0·57	0·31	0·46	0·92	1·70	3·46	3·23	1·75	1·19	0·78	0·55	0·49	15·41

During 1900-15 (1909 and 1911-15 complete) average monthly snowfall was: Jan., 5·7 in.; Feb., 3·1; Mar., 4·3; April, 3·8; May, trace; Sept., 0·7; Oct., 2·1; Nov., 5·0; Dec., 4·8. Mean annual snowfall, 29·5 in.; maximum recorded, 20·5 in., Nov., 1909.

BEAVERLODGE—(REDLOW)

274 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912	0·54	0·05	.....	1·37	0·59	0·96	2·13	2·80	0·11	0·14	0·82	0·36	.....
1913	2·63	0·15	0·33	1·55	0·29	5·18	3·07	2·53	1·55	1·99	0·51	0·17	19·95
1914	1·10	1·45	0·35	0·31	0·11	5·74	0·52	0·32	0·74	0·44	0·37	0·75	12·20
1915	0·25	.....	.....	1·15	1·53	2·40	5·66	1·24	.....	0·77			
Means	1·13	0·55	0·34	1·09	0·63	3·57	2·85	1·72	0·90	0·84	0·57	0·43	14·52

During 1912-15 (1912 and 1915 incomplete) average monthly snowfall was: Jan., 11·3 in.; Feb., 5·5; Mar., 3·4; April, 7·7; May, 0·7; Oct., 3·3; Nov., 4·9; Dec., 4·3. Mean annual snowfall, 41·1 in.; maximum recorded, 26·3 in., Jan., 1913.

PRECIPITATION RECORDS FOR SE[illegible]ED STATIONS IN ALBERTA—*Continued*

DUNVEGAN (PEACE RIVER)—Elevation, 1,320 ft.

275

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1880	1·85	0·69	1·40	0·50	0·79	3·76	1·85	1·21	1·32	1·04	0·26	0·60	15·27
1881	2·90	1·99	0·36	0·96	6·49	6·74	1·72	5·22	2·56	2·50	2·22	1·25	34·91
1882	0·38	1·18	4·80	[illegible]·23	0·79	1·28	1·30	3·32	1·08	1·15	1·45	1·55	19·51
1883	...	...	...	...	...	...	...	...	...	...	...	...	...
1884	...	...	2·55	0·35	0·90	0·52	0·59	2·00	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1904	...	...	...	...	...	...	...	...	...	...	0·74	0·33	...
1905	0·98	0·55	0·88	0·06	1·65	1·17	1·59	2·46	0·61	0·47	0·66	0·08	11·16
1906	0·82	0·46	0·20	0·24	0·85	4·05	1·61	1·14	1·19	1·10	1·27	2·05	14·98
1907	...	1·45	0·45	...	0·72	2·33	1·88	1·90	0·95	0·40	0·14	0·15	...
1908	0·03	0·35	1·75	0·68	0·31	3·33	0·87	1·78	1·32	0·57	0·08	0·35	11·42
1909	0·20	0·23	0·25	0·83	1·28	2·30	0·75	1·14	0·30	0·72	1·25	0·66	9·71
1910	0·37	0·20	0·40	...	2·80	2·26	1·15	1·21	0·66	0·67	0·88	1·30	...
1911	0·85	0·00	0·40	0·44	1·18	1·01	2·32	1·36	2·45	0·00	0·23	0·76	11·00
1912	1·13	0·38	0·05	0·58	0·31	0·79	2·02	2·02	0·00	0·17	0·28	...	...
1913	1·40	0·60	0·10	0·12	1·09	2·00	0·91	3·48	0·00	0·10	0·03	0·00	10·43
Means	0·99	0·67	1·04	0·53	1·47	2·42	1·43	2·17	1·09	0·74	0·73	0·76	14·04

During 1880-1913 (7 years complete) average monthly snowfall was: Jan., 9·9 in.; Feb., 6·7; Mar., 9·0; April, 2·3; May, 0·2; Oct., 2·1; Nov., 5·4; Dec., 7·2. Mean annual snowfall, 42·8 in.; maximum recorded, 37·0 in., Mar., 1882.

LUNNFORD

276

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	...	1·25	0·58	0·71	1·10	3·58	3·32	3·80	1·74	1·31	0·43	1·53	...
1911	1·68	0·28	0·27	0·16	1·61	5·60	4·35	2·66	1·68	0·46	0·45	...	...
1912	2·02	T	0·80	0·73	1·79	2·09	5·60	3·25	0·52	1·06	0·25	0·30	18·41
1913	1·77	0·30	0·30	1·18	0·45	2·33	8·07	2·83	...	...	...	...	...
Means	1·82	0·46	0·49	0·70	1·24	3·40	5·33	3·14	1·31	0·94	0·38	0·91	20·12

During 1910-13 (1912 complete) average monthly snowfall was: Jan., 16·8 in.; Feb., 4·6; Mar., 3·6; April, 2·4; May, 0·0; June, 1·4; Sept., 0·4; Oct., 3·0; Nov., 3·0; Dec., 9·2. Mean annual snowfall, 44·4 in.; maximum recorded, 17·7 in., Jan., 1913.

PEACE RIVER LANDING—Elevation, 1,107 ft.

277

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	...	...	...	...	...	...	...	0·77	1·29	0·29	0·56	0·08	...
1908	0·10	0·23	1·20	0·21	1·33	2·92	2·38	1·84	1·35	0·63	0·15	0·65	12·99
1909	1·20	0·50	0·15	0·81	2·65	1·35	1·54	1·71	1·02	0·90	1·80	0·40	14·03
1910	0·28	0·08	0·75	0·50	1·54	1·98	1·70	1·24	1·15	0·27	0·65	1·06	11·20
1911	1·65	0·40	0·50	0·15	1·29	2·67	4·08	1·76	3·02	...	0·75	0·90	...
1912	0·80	0·15	0·30	0·95	0·80	0·71	1·24	1·24	0·59	0·59	0·30	0·95	8·62
1913	2·10	1·85	...	...	1·60	5·08	1·01	2·91	0·77	1·10	0·30	0·60	...
1914	0·16	0·45	...	...	...	8·60	...	...	...	...	...	...	...
Means	0·90	0·52	0·58	0·52	1·53	3·33	1·99	1·64	1·31	0·63	0·65	0·66	11·26

During 1907-14 (1908-10 and 1912 complete) average monthly snowfall was: Jan., 9·0 in. Feb., 5·2; Mar., 5·8; April, 3·1; Sept., 0·3; Oct., 2·8; Nov., 5·6; Dec., 6·6. Mean annual snowfall, 38·4 in.; maximum recorded, 21·0 in., Jan., 1913.

PEMBINA

278

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1908	...	...	0·60	0·36	1·25	5·61	1·34	2·24	0·00	0·30	T	...	...
1909	...	...	...	...	2·55	...	...	1·47	0·08	...	...	...	...
1910	...	...	...	0·54	1·06	...	0·96	1·71	1·64	0·68	...	0·30	...
1911	0·48	0·55	0·60	0·20	1·02	6·98	2·74	3·91	1·65	...	0·40	0·35	...
1912	...	...	...	0·70	...	1·67	8·00	1·24	...	0·45	0·35	...	...
1913	...	...	0·30	0·75	2·50	...	1·22	...	...	...	...	...	...
Means	0·48	0·55	0·50	0·51	1·68	4·75	2·85	2·11	0·84	0·48	0·25	0·33	15·33

Snowfall in Mar., 1908, 6·0 in.; Oct., 3·0; Nov., trace. In Oct., 1910, trace; Dec., 3·0. In Jan., 1911, 4·8; Feb., 5·5; Mar., 6·0; April, 1·5; Nov., 4·0; Dec., 3·5. In Oct., 1912, 4·5; Nov., 3·5. In Mar., 1913, 3·0; April, 3·5 in.

PRECIPITATION RECORDS FOR SELECTED STATIONS IN YUKON

CARCROSS—Elevation, 2,171 ft.

279

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1907	T	3·49	0·53	0·13	T	0·03	0·43	1·45	0·54	[illegible]	1·71	[illegible]	9·09
1908	...	...	...	...	...	...	...	...	...	...	...	...	...
1909	0·40	0·38	1·23	0·33	0·47	0·55	1·44	1·42	1·68	1·55	0·92	0·40	10·77
1910	0·54	0·63	0·96	0·89	0·28	1·18	3·28	0·92	0·27	0·43	0·96	1·11	11·45
1911	0·65	1·73	0·58	0·35	1·38	0·72	...	...	1·12	1·12	1·28	0·79	...
1912	0·48	0·60	0·10	0·80	0·04	0·61	1·17	1·85	0·47	0·41	0·68	0·94	8·15
1913	1·42	1·03	...	...	0·28	1·01	1·45	1·01	1·30	2·70	1·63	1·60	...
1914	0·70	0·55	0·56	T	0·76	0·49	1·02	0·45	1·89	0·34	0·63	0·15	7·54
1915	0·30	0·32	0·15	0·05	0·55	0·65	0·26	0·20	0·33	0·94	0·75	0·40	4·90
Means	0·56	1·09	0·59	0·36	0·47	0·66	1·29	1·04	0·95	1·04	1·07	0·78	9·90

During 1907-15 (1908 no record, 1913 incomplete) average monthly snowfall was: Jan., 5·6 in.; Feb., 10·9; Mar., 5·3; April, 3·5; May, 0·6; Aug., 0·5; Sept., 1·5; Oct., 5·4; Nov., 10·3; Dec., 7·5. Mean annual snowfall, 51·1 in.; maximum recorded, 34·7 in., Feb., 1907.

PRECIPITATION RECORDS FOR SELECTED STATIONS IN YUKON—*Continued*

DAWSON—Elevation, 1,050 ft.

290 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1897	......	......	....	......	......	......	......	0·42	1·36	......	......	......	....
1901	......	......	......	......	......	0·94	1·32	1·64	1·17	2·25	1·10	1·55	....
1902	1·73	0·20	0·00	0·50	0·46	0·86	3·32	2·38	1·17	0·92	1·10	0·80	13·44
1903	0·50	1·35	0·60	0·60	0·39	0·50	1·11	1·47	2·41	1·25	0·43	0·65	11·28
1904	0·82	0·32	0·20	0·57	0·96	1·71	2·14	1·66	1·01	0·36	0·80	1·45	12·00
1905	0·23	1·30	0·40	0·94	0·97	0·25	1·93	2·51	3·52	1·84	0·24	1·24	15·37
1906	1·26	0·51	0·22	0·42	2·00	0·92	1·20	1·46	1·14	0·47	1·55	0·93	12·08
1907	1·53	0·34	0·88	[illegible]	1·06	0·85	1·93	1·28	2·34	4·09	2·60	0·62	17·73
1908	0·71	1·00	0·71	[illegible]	1·43	1·23	2·43	1·08	1·25	0·69	1·48	1·96	14·29
1909	0·30	0·48	1·21	0·64	0·81	2·66	2·10	0·81	2·40	0·96	0·67	1·17	14·21
1910	1·31	0·22	0·68	1·68	0·19	1·44	0·82	1·67	1·34	1·67	1·46	0·60	13·08
1911	1·52	0·91	0·77	1·30	1·68	0·87	1·37	1·39	0·86	1·60	1·05	1·70	15·02
1912	0·20	1·03	0·60	0·00	0·38	0·75	2·48	1·59	......	2·43	1·12	2·09	....
1913	0·67	1·12	......	......	0·25	......	0·60	0·07	1·20	0·10	0·82	1·45	....
1914	T	0·95	0·20	0·25	1·04	1·73	1·37	1·59	1·21	0·10	0·70	0·08	9·22
1915	0·30	0·50	0·48	1·70	0·55	1·28	0·06	1·80	1·71	0·10	1·30	0·92	10·70
Means	0·79	0·73	0·53	0·70	0·87	1·14	1·61	1·43	1·61	1·26	1·10	1·15	12·92

During 1897-1915 (12 years complete) average monthly snowfall was: Jan., 7·9 in.; Feb., 7·3; Mar., 5·2; April, 5·2; May, 0·5; June, 0·4; Sept., 2·6; Oct., 8·3; Nov., 11·0; Dec., 11·5. Mean annual snowfall, 59·9 in.; maximum recorded, 38·3 in., Oct., 1907.

WHITEHORSE—Elevation, 2,085 ft.

291 — TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1904	......	......	......	......	......	......	......	......	......	......	1·50	0·30	....
1905	1·72	0·00	0·18	0·16	0·15	0·20	3·30	0·92	2·10	1·50	1·20	0·30	11·67
1906	0·55	0·75	0·00	0·23	0·65	1·72	1·55	1·39	0·55	0·30	1·10	0·20	8·99
1907	0·55	0·52	1·45	0·08	0·27	3·03	5·10	1·63	0·86	0·26	0·90	0·30	14·95
1908	......	......	......	......	......	......	......	......	......	......	......	......	....
1909	0·45	0·30	0·40	2·55	0·64	0·87	1·98	2·34	1·37	1·10	0·30	0·08	12·38
1910	0·18	0·06	0·30	0·02	0·03	0·66	4·67	1·36	0·50	0·10	0·33	......	....
1911	0·20	......	......	......	......	......	......	......	......	......	......	......	....
Means	0·61	0·33	0·47	0·60	0·35	1·30	3·32	1·53	1·08	0·65	0·89	0·24	11·37

During 1904-11 (1905-7 and 1909 complete) average monthly snowfall was: Jan., 6·1 in.; Feb., 3·3; Mar., 4·7; April, 5·9; May, trace; Aug., trace; Sept., 3·1; Oct., 2·9; Nov., 7·7; Dec., 2·4. Mean annual snowfall, 36·1 in.; maximum recorded, 25·4 in., April, 1909.

SELECTED PRECIPITATION STATIONS IN UNITED STATES ON INTERNATIONAL WATERSHEDS OR ADJACENT TO BRITISH COLUMBIA

No.	Station	Lat. N.	Long. W.	Elev.	Limiting dates	Complete years	Scattered record		Average annual precipitation
							Mths.	Yrs.	
	KOOTENAY RIVER WATERSHED								
		° ′	° ′	*Feet*		*a*		*c*	*Inches*
	MONTANA								
301	Fortine	48 46	114 55	2,975	Mar. 1906–Dec. 1915	7	32	3	17·91
302	Libby	48 23	115 35	2,075	July 1895–Dec. 1915	5	15	3	16·77
303	Pleasant Valley	48 11	114 55	3,500	Sept. 1907–Aug. 1914	6	12	2	19·22
304	Snowshoe	48 13	115 39	4,500	Feb. 1907–May 1911	2	26	3	66·62
305	Troy	48 28	115 55	1,880	Dec. 1894–Nov. 1910	15	12	2	24·91
	IDAHO								
306	Bonners Ferry	48 42	116 19	2,429	Jan. 1909–Dec. 1915	5	22	2	21·06
307	Porthill	49 0	116 30	1,665	Jan. 1892–Dec. 1915	22	18	2	22·69
	PEND-D'OREILLE (CLARK FORK) RIVER WATERSHED								
	MONTANA								
308	Anaconda	46 7	112 57	5,330	April 1894–Dec. 1915	11	42	5	13·68
309	Butte	46 0	112 33	5,716	April 1894–Dec. 1915	20	17	2	13·87
310	Columbia Falls	48 22	114 11	3,100	Mar. 1893–Dec. 1915	17	40	6	22·69
311	Como	46 5	114 12	3,750	July 1908–Dec. 1915	7	6	1	15·38
312	Dayton	47 52	114 17	2,925	Mar. 1903–Dec. 1915	8	37	5	14·88
313	East Anaconda	46 7	112 55	5,500	Sept. 1905–Dec. 1915	10	4	1	15·02
314	Hamilton	46 15	114 10	3,524	July 1895–Oct. 1915	14	30	5	11·37
315	Hat Creek	46 40†	112 32†	6,000	July 1909–Dec. 1915	6	6	1	23·91
316	Haugan	47 22	115 24	3,150	Feb. 1912–Dec. 1915	3	11	1	27·17
317	Heron	48 3	115 58	2,261	Mar. 1912–Dec. 1915	2	20	2	30·78

a. Number of complete calendar years.
b. Number of additional months in incomplete years.
c. Number of incomplete years.
† Near sea level, exact elevation not known.

SELECTED PRECIPITATION STATIONS IN UNITED STATES ON INTERNATIONAL WATERSHEDS OR ADJACENT TO BRITISH COLUMBIA—*Continued*

No	Station	Lat. N.	Long. W.	Elev.	Limiting dates	Complete years	Scattered record Mths	Scattered record Yrs	Average annual precipitation
	PEND-D'OREILLE (CLARK FORK) RIVER WATERSHED—*Continued*								
		° ′	° ′	*Feet*		*a*	*b*	*c*	*Inches*
318	Kalispell	48 12	114 19	2,965	June 1896–Dec. 1915	19	5	1	15·51
319	Missoula	46 52	114 0	3,225	Nov. 1870–Dec. 1915	31	73	10	15·67
320	Ovando	47 1	113 8	4,050	June 1899–Dec. 1915	13	[illegible]	4	19·50
321	Philipsburg	46 20	113 18	5,273	Oct. 1902–Dec. 1915	11	[illegible]	2	16·10
322	Plains	47 28	114 52	2,473	Sept. 1898–Dec. 1915	16	15	2	13·56
323	Polson	47 41	114 10	2,920	Sept. 1906–Dec. 1915	5	32	4	16·13
324	St. Ignatius	47 19	114 6	2,911	April 1896–Dec. 1915	7	36	5	16·87
325	St. Regis	47 13	115 6	2,647	Jan. 1908–Aug. 1911	1	26	3	22·74
326	Saltese	47 24	115 32	3,600	Nov. 1904–Dec. 1913	8	13	2	34·30
327	Stevensville	46 30	114 6	3,500	Sept. 1911–Dec. 1915	4	4	1	13·99
328	Thompson Falls	47 36	115 21	2,424	Aug. 1911–Dec. 1915	4	5	1	19·85
329	Upper Lake McDonald	48 31†	114 0†	3,200	Oct. 1906–Oct. 1910	1	30	4	30·68
	IDAHO								
330	Lakeview	47 58	116 27	2,450	Aug. 1897–Dec. 1915	15	32	4	28·38
331	Priest River Exp. Sta.	48 11	116 55	2,380	Feb. 1898–Dec. 1915	9	31	4	30·72
332	Sandpoint	48 16	116 33	2,086	Jan. 1911–Dec. 1915	5	0	0	27·17
333	Spirit Lake	47 57	116 52	2,560	Jan. 1909–Mar. 1913	0	27	5	34·21
	WASHINGTON								
334	Cusick	48 20	117 18	2,050	Jan. 1899–June 1908	2	56	8	24·94
335	Newport	48 11	117 4	2,400	Feb. 1910–Dec. 1915	4	11	2	23·78
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN EASTERN WASHINGTON								
336	Colville	48 33	117 55	1,635	Dec. 1859–Dec. 1915	28	67	10	17·57
337	Conconully	48 34	119 45	2,300	July 1894–Dec. 1915	14	28	4	16·67
338	Kettle Falls	48 35	118 7	1,265	Mar. 1909–Dec. 1915	5	21	2	17·81
339	Lakeside	47 50	120 3	1,116	June 1891–Dec. 1915	22	29	3	12·32
340	Laurier	48 59	118 14	1,644	April 1910–Dec. 1915	5	9	1	19·41
341	Loomis	48 49	119 39	1,200	Aug. 1896–July 1907	2	67	9	14·67
342	Northport	48 55	117 47	1,350	Jan. 1909–June 1914	4	15	2	18·35
343	Oroville	48 55	119 26	922	Mar. 1909–Mar. 1915	1	36	6	12·74
344	Republic	48 39	118 45	2,628	Jan. 1900–Mar. 1915	9	51	7	16·07
345	Spokane	47 40	117 25	1,943	Jan. 1881–Dec. 1915	35	0	0	17·42
346	Wilbur	47 46	118 43	2,203	April 1892–Dec. 1915	13	41	6	13·76
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN WESTERN WASHINGTON								
347	Anacortes	48 31	112 38	60	April 1893–Dec. 1915	15	81	8	28·04
348	Baker	48 32	121 45	390	Jan. 1906–Dec. 1915	8	14	2	64·49
349	Bellingham	48 45	122 29	107	June 1857–Dec. 1915	19	42	5	30·75
350	Blaine	48 59	122 45	57	Aug. 1893–Dec. 1915	15	39	6	42·06
351	Clearbrook	48 58	122 21	80	Mar. 1903–Dec. 1915	9	42	4	50·15
352	Coupeville	48 13	122 41	N.S.L.‡	Oct. 1895–April 1909	12	16	3	21·32
353	Granite Falls	48 5	121 58	397	Jan. 1909–Dec. 1915	7	0	0	57·39
354	Olga	48 37	122 49	50	Jan. 1890–Dec. 1915	25	11	1	30·65
355	Olympia	47 1	122 54	142	July 1877–Dec. 1915	37	16	2	54·71
356	Port Angeles	48 7	123 27	N.S.L.	Dec. 1883–Sept. 1908	12	27	4	
357	Mount Pleasant	48 1	123 23	500	Jan. 1911–June 1915	4	6	1	29·30
358	Port Crescent	48 9	123 44	259	Jan. 1909–Dec. 1915	7	0	0	36·95
359	Port Townsend	48 7	122 47	80	Jan. 1860–Dec. 1915	37	43	7	20·55
360	Seattle	47 37	122 20	248	Aug. 1890–Dec. 1915	24	12	2	34·20
361	Sedro-Woolley	48 30	122 15	38	Aug. 1896–Dec. 1915	12	80	8	46·34
362	Snohomish	47 45	122 6	55	Feb. 1894–Dec. 1915	18	34	4	43·39
363	T[illegible]a	47 16	122 28	213	Jan. 1884–Dec. 1915	30	9	2	42·01
364	[illegible] Island	48 23	124 45	86	April 1869–Dec. 1915	29	18	5	83·96
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN ALASKA								
365	Calder	56 10	133 28	N.S.L.	April 1908–Dec. 1915	6	18	2	113·79
366	Juneau	58 19	134 28	N.S.L.	June 1881–Dec. 1915	12	109	18	76·57
367	Killisnoo	57 22	134 29	N.S.L.	June 1881–Dec. 1910	18	113	12	52·76
368	Loring	55 36	131 38	N.S.L.	Mar. 1904–Dec. 1915	11	10	1	153·37
369	Sitka	57 3	135 19	N.S.L.	May 1842–Dec. 1915	47	92	11	84·43
370	Skagway	59 28	135 20	N.S.L.	Nov. 1898–Oct. 1913	2	103	14	23·24
	SU[illegible]PLEMENTARY								
	IDAHO								
371	Burke	47 31	115 48	4,082	Jan. 1909–Dec. 1915	2	21	3	46·87
372	Cœur d'A[illegible]e	47 41	116 48	2,157	Sept. 1881–Dec. 1915	19	44	9	24·84
373	Grand F[illegible]s	47 15†	115 49†	3,000	June 1903–Aug. 1913	1	31	4	52·54
374	Kellogg	47 32	116 7	2,305	Mar. 1905–Dec. 1915	10	10	1	30·04

a. Number of complete calendar years.
b. Number of additional months in incomplete years.
c. Number of incomplete years.
† Approximate.
‡ See explanatory *Note to 5 and 6*, on page 515.

SELECTED PRECIPITATION STATIONS IN UNITED STATES ON INTERNATIONAL WATERSHEDS OR ADJACENT TO BRITISH COLUMBIA—*Continued*

No.	Station	Lat. N	Long. W.	Elev.	Limiting dates	Complete years	Scattered record Mths	Scattered record Yrs.	Average annual precipitation
	SUPPLEMENTARY—*Continued*								
		° ′	° ′	Feet		a	b	c	Inches
	IDAHO—*Continued*								
375	Lewiston	46 25	117 2	757	Jan. 1880–Dec. 1915	27	55	6	14·42
376	Moscow	46 44	117 0	2,748	Jan. 1892–Dec. 1915	21	33	3	22·40
377	Murray	47 38	115 52	2,750	Nov. 1893–April 1900	14	17	3	37·79
378	St. Maries	47 19	116 35	2,263	April 1897–Dec. 1915	9	53	8	28·20
379	Wallace	47 28	115 56	2,770	Jan. 1909–Dec. 1915	4	25	3	41·94
	WASHINGTON								
380	Omak	48 24	119 32	850	Feb. 1909–Dec. 1915	4	28	3	12·00
381	Rex Creek	48 5†	120 28†	1,135	Mar. 1910–July 1913	1	22	3	18·57
382	Snyder Ranch	48 29†	120 7†	2,200	Jan. 1911–Dec. 1915	5	0	0	16·82
383	Stehekin	48 19	120 41	1,100	Feb. 1906–Nov. 1908	1	18	2	27·61
384	Twisp	48 21	120 7	1,619	April 1903–Dec. 1908	4	16	2	14·87
385	Winthrop	48 28	120 10	1,765	Jan. 1911–Dec. 1915	5	0	0	15·84

a. Number of complete calendar years.
b. Number of additional months in incomplete years.
c. Number of incomplete years
† Approximate

MONTHLY AND ANNUAL MEAN PRECIPITATION AT SELECTED STATIONS IN THE UNITED STATES ON INTERNATIONAL WATERSHEDS OR ADJACENT TO BRITISH COLUMBIA

No. on map	Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
	KOOTENAY RIVER WATERSHED													
	MONTANA													
301	Fortine	1·59	1·03	1·09	0·90	2·17	2·71	1·52	1·40	1·63	1·21	1·56	1·10	17·91
302	Libby	1·87	1·04	1·05	0·83	1·26	1·38	0·82	0·91	1·59	0·89	3·27	1·86	16·77
303	Pleasant Valley	1·98	1·54	1·81	1·17	1·80	1·92	1·08	0·93	2·04	1·18	2·69	1·08	19·22
304	Snowshoe	9·20	5·70	6·24	4·21	4·06	3·24	1·95	1·99	3·65	6·44	14·07	5·87	66·62
305	Troy	3·01	1·99	1·83	1·59	1·94	1·85	1·35	0·87	1·77	1·99	4·24	2·48	24·91
	IDAHO													
306	Bonners Ferry	2·84	1·01	0·81	0·85	2·04	1·84	1·44	0·99	1·76	1·71	3·78	1·99	21·06
307	Porthill	3·00	1·77	1·39	1·19	2·14	1·64	1·12	0·87	1·86	1·75	3·54	2·42	22·69
	PEND-D'OREILLE RIVER WATERSHED													
	MONTANA													
308	Anaconda	0·92	0·59	0·72	0·85	2·33	2·51	1·28	0·93	1·28	0·85	0·78	0·64	13·68
309	Butte	0·83	0·76	0·92	1·14	2·21	2·35	1·31	0·89	1·12	0·88	0·75	0·71	13·87
310	Columbia Falls	2·15	1·66	1·14	1·10	2·92	3·12	1·60	1·43	2·04	1·43	2·29	1·81	22·69
311	Como	1·52	0·80	0·82	1·17	1·77	2·38	1·06	0·76	1·53	1·16	1·78	0·63	15·38
312	Dayton	1·15	0·80	0·87	0·76	2·11	2·33	1·51	1·15	1·28	0·98	1·03	0·91	14·88
313	East Anaconda	0·93	0·57	0·50	·14	2·50	2·92	1·58	1·19	1·44	1·02	0·82	0·41	15·02
314	Hamilton	0·86	0·62	0·64	00	1·79	1·85	0·66	0·70	1·12	0·90	0·75	0·48	11·37
315	Hat Creek	1·60	0·92	1·03	1·92	3·13	4·40	2·08	1·35	2·94	2·15	1·54	0·85	23·91
316	Haugan	4·35	2·09	2·01	1·54	1·89	1·97	0·92	0·86	1·68	2·50	4·59	2·77	27·17
317	Heron	3·17	2·37	2·69	1·94	2·48	2·42	1·94	1·24	2·17	2·73	4·79	2·84	30·78
318	Kalispell	1·35	1·05	1·01	0·79	1·94	2·07	1·20	0·94	1·61	0·89	1·72	0·94	15·51
319	Missoula	1·40	0·83	1·00	1·01	2·16	2·22	1·09	0·82	1·29	1·21	1·29	1·35	15·67
320	Ovando	1·93	1·72	1·28	1·11	2·51	2·62	1·24	1·04	1·33	1·22	1·78	1·72	19·50
321	Philipsburg	0·73	0·73	0·92	1·23	2·68	3·30	1·56	0·82	1·45	1·22	1·00	0·46	16·10
322	Plains	1·07	0·69	0·59	0·61	1·80	1·81	1·41	0·91	1·47	0·90	1·55	0·75	13·56
323	Polson	0·98	0·85	0·88	0·87	1·53	2·70	1·39	0·84	1·97	1·31	1·92	0·89	16·13
324	St. Ignatius	[illegible]	0·76	0·84	1·15	2·30	2·50	1·64	1·02	2·23	1·41	1·45	0·53	16·87
325	St. Regis	[illegible]	2·45	1·85	1·51	1·99	2·46	0·38	0·73	1·86	1·69	3·70	1·15	22·74
326	Saltese	[illegible]	3·71	2·95	1·31	2·33	1·96	1·21	1·18	1·90	2·44	5·64	4·08	34·30
327	Stevensville	0·86	0·41	0·46	1·00	2·29	3·05	1·21	0·75	1·40	1·63	0·71	0·22	13·99
328	Thompson Falls	2·42	1·22	1·44	1·59	1·82	1·64	1·72	0·81	1·28	1·74	2·91	1·26	19·85
329	Upper Lake McDonald	4·24	3·37	1·93	1·28	3·23	3·34	2·01	1·08	2·37	2·31	2·14	3·38	30·68
	IDAHO													
330	Lakeview	3·19	2·65	2·06	1·62	2·67	1·96	1·20	1·02	1·76	2·42	4·67	3·16	28·38
331	Priest River Exp. Sta.	3·58	2·38	2·33	2·09	2·90	2·19	1·76	0·98	1·88	2·38	5·37	2·88	30·72
332	Sandpoint	3·51	1·84	1·27	1·57	3·08	2·15	1·30	0·97	2·08	1·77	5·01	2·62	27·17
333	Spirit Lake	5·55	3·10	2·36	1·41	3·45	1·73	1·39	1·39	2·35	1·75	5·59	4·14	34·21
	WASHINGTON													
334	Cusick	2·96	2·76	2·04	1·44	2·67	2·24	1·14	1·24	1·18	1·34	3·01	2·92	24·94
335	Newport	2·69	1·72	1·31	1·58	1·99	1·56	1·31	0·86	1·65	1·88	4·75	2·48	23·78

MONTHLY AND ANNUAL MEAN PRECIPITATION AT SELECTED STATIONS IN THE UNITED STATES ON INTERNATIONAL WATERSHEDS OR ADJACENT TO BRITISH COLUMBIA—*Continued*

No. on map	Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN EASTERN WASHINGTON													
336	Colville	2·23	1·60	1·[illegible]	0·98	1·92	1·54	1·19	0·70	0·90	1·16	2·40	1·82	17·57
337	Conconully	1·76	1·24	1·20	1·00	2·16	1·30	1·08	0·64	1·00	1·00	2·00	1·91	16·67
338	Kettle Falls	2·25	1·05	0·91	0·90	1·92	1·62	1·05	0·66	1·23	1·26	3·02	1·86	17·81
339	Lakeside	1·70	1·27	0·84	0·65	1·41	0·81	0·31	0·35	0·53	0·81	2·01	1·93	12·32
340	Laurier	2·33	1·05	0·98	1·29	2·53	2·04	1·52	0·92	1·30	1·24	2·55	1·75	19·41
341	Loomis	1·08	1·44	0·93	0·86	1·88	1·90	1·10	0·54	0·82	0·91	1·93	1·28	14·67
342	Northport	2·15	0·88	0·91	0·96	1·79	1·80	1·29	1·02	1·20	1·42	2·93	1·91	18·35
343	Oroville	1·11	0·66	0·57	0·85	1·45	1·59	1·19	0·80	0·94	0·66	1·93	0·66	12·74
344	Republic	1·68	1·21	0·91	1·10	2·08	1·74	1·18	0·72	1·07	1·05	1·72	1·61	16·07
345	Spokane	2·29	1·81	1·25	1·14	1·53	1·42	0·73	0·54	0·91	1·31	2·26	2·23	17·42
346	Wilbur	1·72	1·30	0·71	·79	1·65	1·05	0·58	0·60	0·65	1·18	1·86	1·67	13·76
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN WESTERN WASHINGTON													
347	Anacortes	4·19	2·78	2·19	2·05	1·88	1·42	0·63	0·92	1·73	2·66	4·63	3·66	28·04
348	Baker	10·42	6·15	4·38	3·34	3·01	2·43	1·13	1·65	4·21	6·99	12·52	8·26	64·49
349	Bellingham	3·62	2·90	2·62	2·06	2·15	1·69	0·71	1·15	2·24	2·85	4·62	4·12	30·73
350	Blaine	5·79	4·06	3·26	2·49	2·65	2·20	0·88	1·12	3·00	3·81	7·13	[illegible]	42·06
351	Clearbrook	6·72	4·01	3·92	2·61	2·71	2·39	1·34	1·06	3·94	5·09	8·5[illegible]	[illegible]	50·15
352	Coupeville	2·21	2·13	2·03	1·55	1·83	1·43	0·69	0·91	1·50	1·41	2·[illegible]	[illegible]	21·32
353	Granite Falls	8·18	4·87	4·14	4·13	3·92	3·29	1·58	2·06	3·37	6·20	8·[illegible]	[illegible]	57·39
354	Olga	3·50	2·92	2·30	1·96	1·95	1·48	0·73	0·92	2·17	2·91	5·[illegible]	[illegible]	30·65
355	Olympia	8·32	6·61	4·84	3·53	2·60	1·69	0·69	0·65	2·70	4·49	9·[illegible]	[illegible]	54·71
356	Port Angeles													
357	Mount Pleasant	4·91	2·70	1·94	1·57	1·47	1·27	0·41	0·67	1·87	2·47	5·10	4·92	29·30
358	Port Crescent	6·88	3·27	1·91	1·29	1·58	1·33	0·70	0·78	1·97	3·74	8·60	4·90	36·95
359	Port Townsend	2·46	1·83	1·68	1·56	1·85	1·53	0·74	0·77	1·22	1·60	2·74	2·57	20·55
360	Seattle	4·83	3·66	2·70	2·44	2·05	1·46	0·62	0·50	1·80	2·79	6·01	5·44	34·20
361	Sedro-Woolley	5·10	4·40	3·84	3·02	3·12	2·72	1·30	1·77	3·25	4·79	7·44	5·59	46·34
362	Snohomish	5·20	4·48	3·81	3·26	3·11	2·38	1·19	1·15	2·80	3·65	6·60	5·76	43·39
363	Tacoma	6·21	4·36	3·40	2·91	2·37	1·81	0·62	0·68	2·26	3·30	7·28	6·81	42·01
364	Tatoosh Island	12·23	8·60	7·56	5·61	4·03	3·58	1·51	2·00	5·21	7·49	13·06	13·08	83·96
	STATIONS ADJACENT TO BRITISH COLUMBIA—IN ALASKA													
365	Calder	8·87	7·52	9·06	9·41	5·10	3·89	6·02	7·02	12·99	16·72	13·85	13·43	113·79
366	Juneau	6·39	4·54	5·13	5·16	5·28	3·73	4·70	6·97	10·41	9·69	7·50	7·07	76·57
367	Killisnoo	5·05	4·12	3·07	3·01	2·68	2·09	3·39	4·22	6·77	7·57	5·19	5·60	52·76
368	Loring	11·41	10·36	11·34	13·36	8·11	6·01	8·20	8·93	16·16	22·09	20·75	16·45	153·37
369	Sitka	7·39	6·54	5·73	5·65	4·07	3·38	4·26	7·00	10·12	11·75	9·42	8·92	84·43
370	Skagway	1·15	1·32	1·09	1·48	0·62	0·91	1·37	1·78	2·88	4·62	3·50	2·52	23·24
	SUPPLEMENTARY *													
	IDAHO													
371	Burke	6·51	5·22	3·22	3·05	3·08	2·43	2·50	0·42	2·91	3·88	10·26	2·79	46·87
372	Coeur d'Alene	3·68	2·39	2·19	1·82	1·90	1·50	0·73	0·47	·33	1·79	3·62	3·42	24·84
373	Grand Forks	7·22	3·05	4·73	2·96	4·00	1·78	1·43	1·05	[illegible]	3·44	13·50	4·68	52·54
374	Kellogg	3·81	2·88	2·57	1·83	3·36	2·3[illegible]	·04	·95	1·[illegible]	2·74	4·31	2·53	30·04
375	Lewiston	1·44	1·32	1·15	0·97	1·70	1·7[illegible]	·55	0·54	0·86	1·26	1·59	1·47	14·42
376	Moscow	2·84	2·10	2·05	1·48	2·56	1·3[illegible]	[illegible]	0·74	1·27	1·[illegible]9	3·17	2·39	22·40
377	Murray	4·72	3·62	3·59	2·13	3·27	2·7[illegible]	·8	1·37	2·21	2·75	5·63	4·40	37·79
378	St. Maries	3·48	2·59	2·51	1·78	2·77	1·6[illegible]	·3	0·89	1·41	2·18	4·29	3·48	28·20
379	Wallace	4·73	3·65	2·93	2·48	3·55	2·48	1·53	1·43	2·18	3·19	9·43	4·36	41·94
	WASHINGTON													
380	Omak	2·28	0·78	0·42	0·6[illegible]	·38	1·19	0·66	0·38	0·45	0·74	1·71	1·36	12·00
381	Rex Creek	4·00	0·84	1·18	0·64	0·84	0·86	0·18	0·75	1·57	1·92	2·55	3·24	18·57
382	Snyder Ranch	2·87	1·02	0·58	0·7[illegible]	·69	1·57	0·24	0·35	0·99	1·14	3·09	2·51	16·82
383	Stehekin	3·98	[illegible]	1·74	1·48	·56	0·71	0·80	0·36	0·91	2·20	6·90	4·83	27·61
384	Twisp	1·66	1·58	1·00	0·50	1·16	1·35	0·65	0·58	0·70	0·96	2·32	2·21	14·87
385	Winthrop	2·68	[illegible]	0·40	0·76	1·81	1·17	0·55	9·61	1·00	1·09	2·47	2·24	15·84

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA

MONTHLY AND ANNUAL MEAN TEMPERATURES

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
ABBOTSFORD (MATSQUI PRAIRIE)—Elevation, 89 ft.													
1889	33·8	37·5	47·7	51·0	56·9	60·5	64·4	59·5	54·2	52·2	42·0	33·3	49·4
1890	27·5	30·7	41·6	45·6	54·7	57·7	60·9	61·3	55·6	47·7	44·4	42·1	47·6
1891	39·0	29·7	38·3	50·0	57·1	58·2	64·6	64·0	55·5	50·9	48·5	36·6	49·4
1892	35·7	38·9	45·2	46·0	53·8	59·8	60·7	62·8	58·5	49·6	40·0	33·7	48·7
1893	30·7	28·5	40·8	43·8	53·5	55·9	62·0	63·2	55·5	46·2	36·8	37·3	46·2
1894	32·2	33·2	40·3	45·3	54·2	58·3	63·9	65·4	55·8	46·6	42·4	33·5	47·6
1895	32·1	41·0	41·9	47·5	52·7	59·8	62·5	62·1	52·7	51·6	41·4	36·6	48·5
1896	34·1	40·0	39·7	44·6	51·7	59·0	66·0	63·2	56·2	49·7	20·6	39·3	47·1

* See explanatory *Note to 5 and 6*, page 515.

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
ABBOTSFORD (MATSQUI PRAIRIE)—*Continued*													
1897	34·9	38·3	36·0	50·3	57·5	59·6	60·5	67·5	56·0	49·7	36·4	34·8	48·5
1898	34·4	40·7	40·2	47·2	55·5	60·4	62·8	63·7	60·2	49·3	39·3	34·5	49·0
1899	34·7	33·2	40·6	47·5	51·2	57·3	64·0	59·6	58·2	48·5	48·0	36·6	48·3
1900	39·5	35·9	47·4	49·9	54·7	60·2	63·1	59·9	56·2	49·3	38·9	40·5	49·6
1901	33·6	39·3	43·4	45·4	54·3	55·9	60·2	62·6	54·8	54·3	44·0	37·5	48·8
1902	33·7	41·6	41·7	47·8	55·6	57·0	61·2	61·2	60·1	49·7	42·2	34·8	48·9
1903	36·7	35·6	39·4	46·4	52·4	61·9	60·7	61·3	55·9	50·5	40·8	38·4	48·3
1904	36·9	34·8	39·8	51·2	52·7	57·8	63·0	61·2	.....	.....	.....	.....	.....
Means	34·3	36·2	41·5	47·6	54·2	58·7	62·6	62·3	56·3	49·8	40·3	36·6	48·4
AGASSIZ—Elevation, 52 ft.													
1889	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33·4	.....
1890	26·0	29·8	41·6	48·2	57·0	57·7	60·9	63·7	56·5	47·2	46·5	42·6	48·2
1891	.....	.....	.....	49·0	58·7	57·7	65·4	65·7	57·1	51·8	42·6	37·2	.....
1892	35·7	40·2	46·3	46·3	54·3	59·9	60·8	63·0	58·2	50·6	38·6	32·8	48·8
1893	31·4	27·8	41·0	44·1	51·9	55·0	61·5	62·1	55·3	46·0	36·1	36·3	45·7
1894	31·4	33·1	39·3	45·8	53·1	57·3	62·7	64·8	54·6	47·0	42·0	34·2	47·1
1895	31·6	41·4	41·6	47·7	52·1	58·6	61·8	61·2	52·0	51·9	42·4	36·9	48·3
1896	32·4	41·6	40·2	44·7	50·6	56·0	65·8	62·1	54·0	51·9	29·1	40·0	47·4
1897	35·9	40·2	35·8	47·6	54·1	52·3	57·6	64·5	59·0	47·3	36·0	30·1	46·7
1898	34·0	43·3	39·6	45·2	56·9	58·8	60·4	70·3	55·8	49·7	38·7	35·4	49·0
1899	32·4	35·8	41·5	45·1	52·2	58·1	64·8	61·8	56·9	46·8	44·1	37·4	48·1
1900	37·4	37·4	46·4	54·0	54·4	57·0	65·5	60·2	55·5	46·6	36·6	39·2	49·2
1901	35·3	36·0	46·5	46·3	56·3	53·7	60·4	64·7	51·6	49·0	44·4	37·2	48·4
1902	34·4	38·4	40·5	44·4	55·6	61·0	63·4	54·3	51·8	48·2	37·0	34·4	47·0
1903	36·0	34·6	35·2	43·2	48·0	56·8	55·8	55·9	51·4	43·7	36·9	38·5	44·7
1904	33·8	32·7	39·6	47·5	48·0	56·9	57·5	58·8	51·1	54·2	43·0	38·8	46·8
1905	35·4	35·1	50·4	46·2	50·2	58·6	69·2	62·2	51·9	45·2	42·0	41·1	49·0
1906	38·0	45·2	44·6	52·4	54·2	58·5	69·4	63·0	53·8	50·6	40·9	38·5	50·8
1907	22·9	36·3	39·6	48·5	57·0	58·6	64·5	59·1	56·7	52·6	48·2	38·2	48·5
1908	38·8	38·7	42·8	50·3	52·7	62·0	65·6	62·3	52·8	48·3	45·2	38·2	49·8
1909	26·0	36·5	44·8	47·7	52·9	58·2	61·3	61·0	56·9	48·9	41·4	32·8	47·4
1910	37·6	34·8	48·2	50·0	56·8	62·1	66·5	59·4	58·6	49·9	45·0	39·6	50·7
1911	28·0	35·2	42·1	47·1	54·6	56·1	66·0	61·9	56·8	50·9	38·2	39·2	48·0
1912	34·8	41·8	43·0	46·2	57·8	60·4	61·2	61·0	56·4	47·8	42·4	39·4	49·3
1913	28·8	34·9	40·3	51·3	52·2	58·3	62·5	64·5	56·5	47·7	43·7	40·2	48·4
1914	38·0	39·6	45·0	51·6	56·3	57·2	62·1	63·0	54·2	50·4	42·6	35·2	49·6
1915	37·4	41·0	48·1	50·2	54·3	59·4	62·9	66·2	56·7	47·9	40·1	38·0	50·2
Means	33·3	37·3	42·6	47·7	53·9	57·9	62·9	62·2	55·1	48·9	40·9	37·2	48·3
ALBERNI (BEAVER CREEK P.O.)—Elevation, 300 ft.													
1894	.....	.....	.....	43·9	52·8	60·1	64·4	67·6	57·2	48·1	44·3	34·9	.....
1895	34·7	39·7	40·3	44·5	50·8	58·9	64·3	64·0	53·3	52·4	42·2	37·1	48·5
1896	.....	.....	43·7	47·8	58·0	62·8	71·8	69·0	59·8	54·8	38·5	42·3	.....
1897	39·8	39·3	38·4	53·0	60·9	62·6	67·8	75·0	58·3	54·2	42·8	42·5	52·9
1898	37·7	38·5	45·3	52·1	56·7	57·2	69·5	74·9	65·4	52·1	44·8	.....	.....
1899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1900	.....	36·5	46·4	49·0	54·4	60·5	65·6	62·5	57·9	48·0	39·5	40·4	.....
1901	33·6	35·1	41·0	43·7	52·3	57·4	60·2	66·5	55·7	53·8	44·2	38·5	48·5
1902	35·9	39·6	41·6	47·3	56·8	59·9	62·4	63·3	53·3	52·6	40·7	34·8	49·0
1903	35·9	35·2	38·3	47·2	53·4	62·2	62·4	63·7	55·8	49·3	38·1	36·6	48·2
1904	34·3	33·6	35·5	48·8	52·5	58·3	65·2	66·4	60·9	53·8	46·0	37·2	49·4
1905	35·7	42·5	47·0	50·7	54·4	62·6	66·6	63·5	58·4	48·0	44·1	38·7	51·0
1906	35·6	42·2	44·9	51·5	56·8	56·9	68·8	66·5	58·1	52·3	41·1	35·7	50·9
1907	26·6	40·4	41·4	47·7	58·8	62·9	68·7	62·9	61·3	53·7	.....	36·2	.....
1908	34·4	36·8	41·7	47·3	51·7	59·9	66·5	65·6	56·7	49·9	45·5	34·4	49·2
1909	29·1	37·4	42·8	47·5	52·2	57·0	61·5	60·8	59·9	49·5	38·8	31·9	47·4
1910	32·2	34·0	43·1	46·5	55·5	54·6	62·1	61·1	57·3	48·4	37·3	38·3	47·5
1911	31·1	35·5	43·6	44·4	51·6	56·1	64·9	64·0	57·0	51·1	37·3	36·5	47·7
1912	34·2	39·4	43·2	46·2	54·9	59·7	63·2	61·0	59·1	47·0	41·2	34·7	48·7
1913	31·0	37·0	38·3	44·4	52·0	53·7	62·5	61·5	55·7	47·4	39·2	36·7	46·6
1914	36·1	37·1	44·2	49·4	54·3	57·7	63·6	66·9	55·5	53·0	42·6	34·4	49·5
1915	35·1	40·1	47·4	51·5	55·4	61·1	65·0	66·8	59·6	50·6	38·5	34·8	50·5
Means	34·1	37·9	42·5	47·8	54·5	59·2	65·1	65·4	57·9	51·0	41·3	36·[illegible]	49·5
ATLIN—Elevation, 2,240 ft.													
1905	.....	.....	.....	.....	.....	.....	.....	.....	42·4	34·2	30·4	20·2	.....
1906	2·2	0·7	21·3	33·9	45·0	49·3	53·6	51·2	42·8	37·9	23·2	–0·1	30·1
1907	–9·0	–1·2	10·1	31·3	46·2	50·1	54·8	51·8	45·0	37·9	27·7	18·9	30·3
1908	16·2	10·8	14·3	31·9	42·6	50·9	53·2	52·3	41·1	29·2	25·2	17·5	32·1
1909	–18·5	–3·1	23·7	29·2	42·9	50·0	52·6	49·8	43·7	32·6	5·6	8·3	26·4
1910	10·8	–3·4	21·0	29·1	42·1	47·4	52·3	49·5	46·2	36·2	18·1	7·3	29·7
1911	–8·8	10·3	14·5	26·1	41·1	48·5	52·9	53·8	46·0	36·9	18·2	19·2	29·9
1912	–0·5	18·1	20·4	33·7	45·8	47·7	53·2	49·0	46·3	37·5	24·6	21·4	33·2
1913	–1·1	15·3	19·3	31·3	41·3	51·8	52·2	[illegible]·4	43·8	32·4	23·6	20·3	31·6
1914	–5·7	12·3	21·3	31·6	42·5	50·0	50·0	51·0	41·9	38·8	23·6	10·1	30·6
1915	15·0	7·1	30·8	37·7	47·0	53·1	59·9	54·1	47·7	31·9	24·9	19·3	35·7
Means	0·1	6·7	19·6	31·6	43·7	49·9	53·5	51·2	44·3	35·0	22·3	14·8	31·1

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

BARKERVILLE—Elevation, 4,180 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1888	.....	26·4	.....	34·1	48·0	54·3	53·6	58·3	52·6	38·2	24·9	21·8	.....
1889	19·7	19·1	33·6	37·5	46·3	50·3	57·6	53·1	44·0	42·8	29·2	13·6	37·2
1890	.....	.....	27·1	30·3	45·4	49·8	53·1	53·8	46·3	35·6	33·7	24·3	.....
1891	26·4	4·6	28·8	35·0	44·8	47·6	55·2	56·6	45·4	41·6	27·7	18·6	35·5
1892	15·2	.....	30·8	28·8	.....	52·9	51·0	53·4	49·7	42·1	22·8	20·6	.....
1893	16·8	10·3	27·9	33·1	44·6	46·8	54·3	56·6	49·2	34·4	20·4	21·5	34·6
1894	15·0	19·1	26·6	35·1	44·3	50·9	57·0	58·8	44·5	35·7	27·9	18·2	36·1
1895	14·2	24·4	28·2	36·4	43·8	50·2	54·8	54·4	39·2	42·5	29·5	20·8	36·5
1896	12·6	25·3	21·0	33·0	41·5	49·7	59·3	57·1	47·9	39·5	5·2	26·0	34·8
1897	18·8	20·7	16·9	39·5	50·6	54·1	52·7	60·6	47·8	39·5	14·8	23·4	36·6
1898	21·4	25·0	22·4	36·9	48·4	54·1	.....	61·5	48·9	34·6	22·0	20·4	.....
1899	18·5	14·0	20·6	31·8	38·6	47·2	56·2	50·9	49·4	34·3	35·1	21·8	34·9
1900	23·5	19·7	31·3	40·4	46·3	53·0	55·4	50·7	46·2	34·4	22·8	27·3	37·6
1901	14·9	19·2	29·3	32·9	44·6	47·4	51·9	56·2	44·2	43·6	31·2	24·1	36·6
1902	17·3	27·1	24·4	35·6	44·8	47·3	52·8	51·7	43·8	40·3	23·7	18·4	35·6
1903	19·3	21·1	20·2	31·3	43·3	54·9	52·3	51·2	40·2	36·7	24·7	25·5	35·1
1904	19·5	9·9	20·2	39·8	40·6	48·2	53·5	55·0	48·6	39·3	34·1	22·9	36·0
1905	15·5	20·4	32·9	37·0	45·9	49·9	55·8	51·0	45·0	31·0	28·6	24·1	36·4
1906	19·5	24·5	26·0	38·9	47·1	48·2	59·7	52·7	42·9	38·3	26·1	19·0	36·9
1907	.....	.....	.....	31·2	44·5	.....	57·8	48·9	45·1	42·0	28·7	20·5	.....
1908	20·4	19·1	22·2	31·8	42·5	50·4	56·5	53·7	45·0	37·0	33·5	[illegible]·8	36·6
1909	3·9	17·1	28·1	29·5	40·8	48·1	52·8	47·5	45·2	35·8	20·3	11·6	31·7
1910	16·4	12·1	32·1	35·9	43·8	46·5	52·0	49·4	43·1	34·4	24·0	22·9	34·4
1911	5·0	15·8	29·4	28·7	41·5	47·4	52·8	50·2	43·6	37·6	18·0	18·9	32·4
1912	12·7	25·1	25·3	36·5	45·8	51·6	52·5	51·0	43·9	33·6	26·7	21·0	35·5
1913	8·1	14·7	20·9	34·0	41·9	51·4	51·9	52·1	43·8	32·3	26·1	24·4	33·4
1914	16·7	20·9	26·1	37·1	43·1	50·4	52·1	51·9	43·7	41·7	26·6	11·8	35·2
1915	19·6	25·0	32·6	40·4	47·0	49·5	54·0	56·8	45·0	36·7	20·7	20·0	37·3
Means	16·4	19·2	26·1	34·8	44·4	50·1	54·4	53·7	45·5	37·7	25·3	20·9	35·7

BELLAKULA—Elevation, 150 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1898	27·6	32·3	38·3	44·4	54·3	59·3	62·8	67·1	55·6	43·9	31·6	28·0	45·3
1899	27·6	30·2	35·3	43·9	49·4	54·9	64·9	58·6	54·6	41·7	41·7	32·2	44·6
1900	32·9	31·2	39·4	43·9	52·5	59·8	64·2	60·0	55·4	.....	.....	35·8	.....
1901	.....	.....	39·2	.....	53·6	.....	59·4	63·1	54·7	49·8	37·7	33·8	.....
1902	26·2	37·7	38·2	46·0	54·8	57·7	61·6	57·6	53·3	45·9	34·2	26·1	44·9
1903	28·1	27·5	32·0	43·7	50·3	59·8	61·0	60·8	51·0	44·7	32·8	34·2	43·8
1904	30·4	21·7	31·0	45·7	50·4	55·3	60·2	60·8	53·0	46·9	40·1	33·6	44·1
1905	27·9	30·0	41·9	48·1	54·2	63·0	66·7	.....	.....	.....	.....	.....	.....
1906	.....	.....	.....	48·6	.....	56·1	65·0	61·1	51·6	47·1	37·8	26·7	.....
1907	14·8	28·8	36·2	42·4	54·3	57·4	63·0	58·5	56·1	47·4	37·8	31·3	44·0
1908	28·7	29·5	34·8	42·0	50·1	56·7	59·5	61·2	51·3	43·8	39·7	29·8	43·9
1909	14·7	26·9	37·9	42·7	50·4	55·6	59·5	55·5	54·4	46·3	32·3	22·3	41·5
1910	26·7	25·6	37·8	42·6	52·2	53·0	60·0	58·1	55·5	44·4	35·0	34·4	43·7
1911	19·1	28·7	38·8	40·1	51·0	54·3	61·5	61·7	54·2	44·5	30·1	30·9	42·8
1912	24·9	37·2	39·8	45·3	54·2	57·9	61·6	59·0	55·2	44·2	37·5	34·2	45·8
1913	21·5	31·3	34·6	43·2	49·5	56·8	59·4	59·8	52·6	44·0	36·7	34·2	43·6
1914	27·6	32·7	38·8	47·6	52·8	57·8	58·3	60·9	53·6	50·0	37·7	27·1	45·3
1915	31·4	35·5	44·3	46·8	55·5	59·0	63·5	62·4	55·4	[illegible]·5	34·1	33·1	47·1
Means	25·7	30·4	37·6	44·5	52·3	57·4	61·8	60·3	54·0	45·6	36·1	31·0	44·7

CHILCOTIN (BIG CREEK)—Elevation 3,100 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1893	18·5	8·4	28·1	35·9	54·1	53·3	60·7	.....	54·1	38·7	20·4	.....	.....
1894	.....	.....	.....	41·6	49·9	56·3	62·3	63·8	49·7	39·4	.....	14·2	.....
1895	8·7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1896	.....	24·0	28·2	41·4	.....	.....	64·2	63·0	52·8	41·0	2·3	24·3	.....
1897	12·7	22·3	21·0	.....	.....	.....	60·0	66·4	.....	.....	.....	.....	.....
1898	17·2	21·5	27·5	43·4	.....	.....	64·1	69·0	.....	.....	.....	.....	.....
1899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	39·9	24·3	.....
1900	24·8	20·9	34·6	48·4	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1904	.....	6·5	16·9	42·3	43·6	52·0	57·9	58·0	50·9	40·9	31·3	18·0	.....
1905	12·2	16·4	34·6	38·4	45·9	54·2	60·2	55·0	46·5	32·5	28·0	19·0	36·9
1906	14·6	22·5	26·1	43·5	48·5	50·6	63·7	57·1	47·0	40·0	25·4	10·3	37·4
1907	−4·4	19·4	22·1	35·6	49·3	53·2	58·8	53·8	49·6	42·8	29·7	16·5	35·5
1908	16·2	16·3	25·0	35·2	45·1	52·0	59·2	57·6	46·6	36·1	30·7	14·9	36·2
1909	−1·0	15·5	32·5	35·6	44·8	52·7	57·3	53·3	51·1	38·5	20·5	11·6	34·5
1910	14·4	11·4	33·8	39·8	48·4	50·3	57·2	54·9	47·5	37·6	23·3	20·9	36·6
1911	2·0	14·9	33·0	34·9	45·0	52·0	59·1	57·0	47·7	39·1	17·9	18·0	35·1
1912	11·2	23·7	26·2	38·9	49·6	56·1	57·4	54·4	46·6	35·6	26·5	20·3	37·2
1913	8·8	16·0	22·4	37·3	44·8	52·5	55·1	55·1	46·4	34·7	.....	20·9	.....
1914	14·0	19·9	29·1	40·5	45·9	52·1	57·0	56·8	47·6	42·1	26·8	13·6	37·1
1915	14·1	23·9	34·1	42·6	48·5	53·3	57·9	60·2	49·3	39·8	22·0	18·5	38·7
Means	11·5	17·9	28·0	39·7	47·4	52·9	59·7	58·5	49·9	38·7	24·6	17·7	37·1

TEMPERATURE RECORDS FO:. SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
CHILLIWACK—Elevation, 21 ft.													
1895	.....	42·7	42·4	48·2	52·7	59·8	62·4	60·6	53·4	51·3	42·9	37·4	.....
1896	32·8	40·9	40·9	46·3	54·1	61·4	68·8	65·1	57·4	49·1	30·2	38·3	48·8
1897	35·3	38·7	35·6	55·5	60·0	62·0	63·6	68·5	55·7	49·1	35·6	35·0	49·5
1898	34·1	40·1	40·7	50·5	57·5	61·2	66·0	67·1	.....	48·5	38·9	35·1	.....
1899	35·0	34·3	41·7	48·2	52·3	58·9	64·4	.....	59·0	48·5	.....	.....	.....
1900	.....	.....	51·0	52·2	56·7	61·5	.....	.....	.....	.....	.....	.....	.....
1901	.....	.....	.....	47·0	55·8	57·3	61·6	63·5	56·5	54·1	44·4	38·6	.....
1902	35·6	40·9	42·5	50·0	57·0	60·1	62·5	62·4	56·2	51·7	39·7	33·8	49·4
1903	37·0	37·4	40·8	47·9	54·5	63·8	62·3	62·4	55·1	50·7	41·1	39·0	49·3
1904	37·3	33·3	39·9	52·6	54·8	59·6	64·5	62·7	.....	.....	.....	39·5	.....
1905	37·0	38·4	48·9	51·5	55·2	61·1	65·6	62·4	57·6	45·6	42·2	38·3	50·3
1906	37·2	42·5	44·7	52·3	55·4	58·7	69·4	63·7	56·9	51·3	41·0	37·5	50·9
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1910	.....	.....	.....	.....	.....	56·8	62·1	59·1	58·1	50·4	41·3	39·6	.....
1911	26·0	336·	43·9	46·6	52·4	57·0	64·1	62·5	56·5	50·5	37·8	37·0	47·3
1912	31·3	417·	41·5	47·7	56·9	60·3	64·0	62·0	56·7	46·9	42·0	38·4	49·1
1913	27·1	336·	39·2	49·0	53·7	58·8	63·4	63·9	55·8	47·8	40·4	38·6	47·6
1914	36·9	374·	45·1	51·2	54·8	58·8	63·2	61·7	54·7	52·0	43·3	34·1	49·5
1915	36·7	41·3	48·9	51·9	56·4	59·5	64·6	65·1	57·4	50·2	39·7	36·6	50·7
Means	34·2	38·5	42·9	49·9	55·3	59·9	64·3	63·3	56·5	49·9	40·1	37·3	49·3
CLAYOQUOT—Elevation, 40 ft.													
1897	42·1	41·6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1898	.....	.....	.....	.....	.....	55·2	57·9	60·1	56·6	48·9	44·3	42·5	.....
1899	41·2	39·4	40·8	45·2	47·1	53·1	.....	.....	.....	.....	.....	.....	.....
1900	.....	.....	.....	.....	.....	.....	58·4	58·1	55·8	49·3	44·0	45·3	.....
1901	40·3	38·4	43·3	44·0	50·0	51·5	55·2	58·7	54·0	53·4	49·0	43·2	48·4
1902	41·4	45·8	42·4	47·2	51·1	55·0	56·9	55·6	54·0	52·3	44·3	41·3	48·9
1903	40·5	38·5	39·4	42·8	48·0	55·4	56·2	57·7	53·5	50·5	43·0	42·0	47·3
1904	38·3	37·7	38·6	46·8	48·1	50·8	56·5	56·1	56·0	52·2	49·2	45·1	47·9
1905	41·9	41·1	45·8	47·1	49·3	54·9	58·6	59·5	55·2	47·7	46·7	43·7	49·3
1906	41·2	43·4	43·9	47·0	54·2	56·0	63·0	62·5	56·2	52·2	41·9	41·7	50·3
1907	34·6	43·0	41·4	46·0	53·3	56·6	62·6	60·8	59·2	53·4	46·9	42·2	50·0
1908	42·0	40·2	42·2	46·0	49·3	55·1	58·3	57·6	56·5	52·5	46·3	38·8	48·7
1909	35·6	.....	.....	44·7	47·1	53·8	56·5	56·8	54·8	50·1	43·3	38·5	.....
1910	38·5	39·3	43·6	44·6	50·9	52·8	57·1	56·5	56·4	50·3	44·6	43·0	48·1
1911	36·2	37·7	43·4	43·2	49·5	52·8	58·7	58·4	54·6	51·4	44·5	40·7	47·6
1912	41·9	43·8	43·2	46·4	51·8	55·4	58·5	58·3	57·0	49·6	44·8	41·4	49·3
1913	37·1	40·1	43·0	46·7	52·0	55·8	60·5	60·2	54·9	47·8	43·2	43·1	48·7
1914	41·1	42·3	45·2	48·9	54·8	55·4	58·8	59·1	54·2	53·1	45·5	41·2	50·0
1915	40·3	42·1	47·9	50·1	53·3	58·0	60·1	62·5	57·9	50·8	42·1	40·4	50·5
Means	39·6	40·9	43·0	46·1	50·7	54·6	58·5	58·7	55·7	50·9	45·0	42·1	48·8
COWICHAN (TZOUHALEM)—Elevation, 170 ft.													
1904	..	36·3	38·6	48·6	51·0	56·0	62·0	61·0	57·0	50·5	46·4	39·1	.....
1905	35·8	37·0	45·8	47·9	51·7	58·0	63·2	60·3	55·9	44·5	41·9	38·2	48·4
1906	38·0	40·6	41·3	49·2	52·2	54·5	.....	.....	.....	.....	.....	.....	.....
1907	30·0	40·4	40·3	46·9	56·1	59·6	64·[illegible]	61·1	58·1	51·3	46·3	40·0	49·5
1908	38·8	38·8	43·0	47·2	52·6	58·7	60·2	62·9	54·9	48·5	46·8	37·6	49·2
1909	29·9	39·6	42·4	45·9	52·7	58·4	61·5	60·2	57·3	49·8	42·1	34·2	47·9
1910	35·9	34·9	45·6	47·4	55·4	56·1	63·5	60·2	57·0	50·4	43·3	41·0	49·2
1911	33·9	37·6	43·2	45·0	52·3	57·2	63·3	62·6	55·7	48·0	40·0	40·0	48·3
1912	37·6	40·9	40·2	49·9	55·3	59·6	63·4	61·7	55·5	47·4	43·6	39·5	49·5
1913	33·2	36·9	39·6	47·6	53·3	58·6	62·7	63·9	46·0	47·7	41·7	39·4	47·5
1914	40·2	39·8	45·4	50·0	55·5	58·7	63·9	62·4	55·4	52·1	43·8	36·0	50·3
1915	37·1	42·1	47·0	51·6	55·0	60·2	64·0	66·1	57·7	51·0	40·7	38·9	50·9
Means	35·5	38·8	42·8	48·1	53·6	57·9	62·9	62·0	55·5	49·3	43·3	38·5	49·0
CRANBROOK—Elevation, 3,014 ft.													
1901	.	21·1	34·6	38·9	51·7	51·4	60·7	66·5	48·4	43·7	34·6	.....	.....
1902	19·5	26·3	32·3	38·5	51·7	52·0	58·7	60·2	49·7	42·1	28·9	17·3	39·8
1903	16·3	12·8	24·7	39·9	46·8	60·0	56·6	.....	.....	.....	.....	.....	.....
1904	22·8	21·2	26·8	44·2	49·7	53·4	.....	.....	.....	.....	.....	.....	.....
1905	18·2	13·7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1909	.....	.....	.....	.....	.....	56·9	61·3	59·0	54·5	42·9	32·5	12·9	.....
1910	15·9	13·0	40·4	46·3	52·7	57·4	62·9	55·9	53·6	48·6	31·7	23·4	41·8
1911	14·0	20·1	36·4	41·8	48·3	59·8	61·4	.....	53·3	40·1	23·0	20·8	.....
1912	14·9	29·8	27·1	44·9	52·9	62·9	59·9	59·7	47·0	37·5	32·5	23·7	41·1
1913	13·7	13·2	26·7	43·5	51·5	58·7	61·2	61·6	51·9	39·5	32·5	21·4	39·6
1914	25·9	19·6	.....	46·0	51·9	57·5	64·5	61·5	51·9	43·4	34·8	10·4	.....
1915	18·9	29·0	37·7	48·5	53·0	56·9	60·5	66·8	49·7	44·9	25·8	21·2	42·7
Means	17·9	20·0	31·8	43·3	51·0	57·0	60·8	61·4	51·1	42·5	30·7	18·9	40·5

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

FORT ST. JAMES (STUART LAKE)—Elevation, 2,280 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1894	3·2	11·3	21·9	35·2	42·2	52·1	55·1	56·7	44·3	35·1	22·5	9·6	32·4
1895	−0·5	12·5	24·7	35·3	44·8	50·2	53·6	51·6	39·8	37·3	28·0	15·6	32·7
1896	−1·2	19·6	16·6	30·6	42·2	48·9	53·7	52·9	43·4	34·2	−0·3	21·8	36·2
1897	11·2	14·7	14·6	38·4	47·2	55·7	54·9	57·1	46·1	40·7	10·2	17·3	34·0
1898	18·5	18·6	23·8	43·7	54·0	56·4	56·0	58·2	47·4	34·7	20·9	7·4	36·6
1899	18·6	18·2	18·4	33·1	39·3	49·3	57·3	50·6	43·0	29·5	28·0	12·2	33·2
1900	11·0	5·5	12·7	32·2	39·9	46·3	51·3	47·4	41·9	31·0	19·5	22·9	34·3
1901	8·7	14·1	29·3	30·0	40·0	44·9	48·7	50·9	41·6	38·2	27·4	20·2	32·8
1902	10·4	[illegible]	18·0	32·4	44·2	47·9	52·4	52·5	46·2	43·4	24·5	9·9	33·2
1903	15·4	[illegible]	13·9	33·9	43·0	55·0	54·7	52·3	42·7	38·5	23·8	24·2	34·7
1904	14·6	1·6	18·9	39·8	42·8	50·2	55·3	53·5	47·3	40·4	36·7	22·2	35·3
1905	6·2	9·2	31·8	35·7	46·6	54·2	58·7	53·5	44·4	33·0	28·3	22·8	35·4
1906	10·9	14·0	22·6	37·4	47·1	50·3	60·4	54·0	44·2	39·4	28·0	7·9	34·7
1907	−14·9	16·1	17·3	32·9	45·4	[illegible]	56·5	52·6	46·7	39·0	30·1	18·8	32·6
1908	13·3	12·1	19·1	33·8	42·8	50·2	54·0	50·8	43·0	33·4	25·5	13·2	32·6
1909	−9·7	8·2	29·8	33·7	44·4	51·5	54·6	51·3	48·3	39·7	20·0	7·5	31·6
1910	14·8	10·0	32·3	37·2	45·9	49·8	......	53·2	46·8	38·5	25·9	23·5	......
1911	0·0	8·5	28·5	30·7	44·0	49·9	55·8	54·0	48·9	37·8	18·7	19·3	33·0
1912	2·9	20·9	15·5	36·4	47·5	51·7	55·2	54·0	47·1	36·8	28·1	23·0	34·9
1913	3·1	11·5	20·8	37·2	42·2	53·2	54·2	55·3	46·9	37·1	28·3	......	......
1914	9·9	18·0	25·1	35·7	43·6	54·6	55·1	57·1	47·2	42·4	29·3	7·2	35·4
1915	11·9	20·1	35·2	40·6	51·8	57·7	62·0	62·4	50·1	39·5	22·7	20·1	39·5
Means	7·2	15·9	22·3	35·3	44·6	51·5	55·2	53·6	45·7	37·3	23·9	16·5	34·1

FRENCH CREEK (LITTLE QUALICUM)—Elevation, 125 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1893	......	......	......	......	......	59·6	59·7	60·6	54·4	46·1	37·9	38·9	......
1894	34·2	35·4	39·4	43·8	51·5	56·7	61·3	61·8	54·7	45·5	41·7	35·2	46·7
1895	33·5	39·3	40·7	45·0	51·9	57·8	61·2	60·7	51·0	48·2	41·2	37·0	47·3
1896	35·2	38·9	37·9	52·2	49·3	55·6	63·6	62·3	54·0	47·1	32·6	40·8	47·5
1897	37·3	38·7	36·7	47·0	54·0	60·8	62·9	67·8	53·8	47·2	37·6	37·7	48·5
1898	36·7	39·9	39·9	45·6	53·0	57·7	62·3	65·2	57·1	47·5	40·1	36·5	48·5
1899	34·4	35·8	39·8	44·8	49·4	55·0	62·4	59·5	60·6	46·7	47·2	39·2	47·9
1900	38·9	36·5	44·2	47·6	51·2	56·6	62·1	59·2	55·0	47·1	39·2	41·5	48·3
1901	35·2	37·5	41·4	44·6	50·7	54·9	57·5	61·0	54·8	51·1	44·2	38·1	47·6
1902	35·2	41·8	41·3	45·9	52·9	56·7	60·0	60·7	53·6	48·8	41·1	36·5	47·9
1903	38·9	36·5	39·6	......	......	......	......	......	......	......	......	......	......
Means	35·9	[illegible]	40·1	46·3	51·5	57·1	61·3	61·8	54·9	47·5	40·3	38·1	47·7

FRUITLANDS (ELKO)—Elevation, 2,684 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1896	......	35·6	33·8	44·0	52·9	63·6	68·7	61·8	52·3	44·4	21·7	33·8	......
1897	25·1	28·9	25·2	48·6	[illegible]	58·4	60·7	66·0	55·4	43·1	31·7	23·5	44·2
1898	22·2	35·2	30·8	46·1	52·5	58·1	65·7	69·6	53·7	42·0	32·7	21·4	44·2
1899	24·6	17·4	32·3	41·7	49·1	56·4	63·6	55·7	56·3	44·1	41·8	30·0	42·8
1900	31·9	22·9	39·4	48·0	53·1	62·2	64·1	56·7	53·2	43·6	26·7	35·6	44·8
1901	21·1	23·9	37·6	42·2	55·7	50·9	62·2	64·4	49·6	45·8	37·6	28·9	43·3
1902	21·7	29·6	34·7	41·4	51·4	54·8	59·8	61·3	51·4	45·2	33·4	26·3	42·6
1903	27·0	17·3	32·9	41·8	48·4	63·0	62·1	62·6	50·8	44·0	28·4	30·0	42·3
1904	26·3	27·4	30·0	45·4	51·9	58·2	65·7	62·0	55·2	45·6	39·1	28·0	44·6
1905	22·3	13·3	40·9	46·6	53·0	59·4	67·3	67·5	57·2	39·5	32·5	27·4	43·9
1906	27·6	29·2	31·9	48·9	53·2	59·6	72·3	66·0	59·7	48·9	32·0	28·4	46·4
1907	9·4	28·6	34·9	41·6	53·3	59·8	64·7	58·8	52·9	47·0	35·7	28·5	42·9
1908	25·0	27·4	34·9	47·4	51·9	59·3	68·7	65·0	......	......	37·0	25·5	......
1909	14·5	31·3	38·1	41·6	52·2	61·7	65·4	64·0	58·9	46·2	36·8	19·5	44·2
1910	22·2	18·6	42·3	51·3	57·3	62·7	69·7	62·8	53·6	49·3	37·1	31·0	46·7
1911	19·9	26·8	40·1	45·0	52·1	64·5	65·6	62·5	54·0	43·3	25·3	22·7	43·5
1912	17·4	30·2	30·1	46·8	55·1	64·7	62·0	62·4	[illegible]	42·4	36·3	30·0	43·9
1913	18·2	18·2	28·8	45·4	52·3	62·5	64·3	65·3	56·4	42·9	36·2	24·4	42·9
1914	30·7	24·3	37·4	50·4	53·8	59·3	69·1	67·3	54·8	45·8	37·1	14·9	45·4
1915	21·4	31·9	38·8	51·9	55·4	58·5	62·1	70·9	53·4	47·6	32·2	25·4	45·8
Means	22·5	25·9	34·8	45·8	53·5	59·7	65·2	63·6	54·3	44·	33·5	26·7	44·2

GLACIER—Elevation, 4,072 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1892	......	......	......	......	......	......	......	......	......	39·5	......	......	......
1893	......	......	27·2	37·9	45·9	47·0	54·5	55·1	......	......	......	......	......
1894	19·0	18·5	29·8	37·0	45·2	51·4	58·5	58·8	44·1	37·8	27·6	14·4	36·8
1895	18·0	21·4	28·0	33·8	52·7	......	......	......	......	40·6	31·1	20·5	......
1896	17·5	27·4	23·6	34·6	43·3	51·1	60·5	56·3	49·1	39·6	16·7	......	......
1897	......	......	16·5	40·9	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1902	......	......	28·3	36·2	48·0	49·8	56·2	54·7	45·9	41·0	25·7	19·6	......
1903	19·8	18·9	23·8	35·8	44·4	55·6	......	......	......	......	......	......	......
1904	20·0	17·2	21·5	40·2	44·9	47·8	56·2	59·8	......	......	......	......	......
1905	17·5	11·2	30·9	33·4	44·9	50·7	58·2	55·8	46·4	29·9	25·6	21·2	35·5
1906	19·0	21·3	......	38·2	......	......	......	......	......	......	......	......	......
1907	......	......	......	......	......	......	......	......	......	......	......	......	......
1908	17·9	17·0	22·8	31·6	43·2	51·1	57·9	54·7	45·7	35·9	28·3	15·7	35·2
1909	3·0	20·1	26·7	30·2	41·9	51·4	56·5	52·1	49·0	36·8	27·5	13·2	34·0

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
GLACIER—*Continued*													
1910	13·9	9·4	31·6	36·4	44·2	50·5	56·0	50·9	45·5	37·1	25·3	23·1	35·3
1911	9·0	16·2	28·8	31·5	41·2	50·8	56·1	52·1	44·4	36·8	18·6	17·7	33·6
1912	10·6	23·8	22·6	37·1	46·2	56·6	54·2	54·1	44·9	33·7	27·2	17·4	35·7
1913	11·7	11·7	18·9	33·6	40·4	51·8	54·3	54·9	44·0	33·8	26·2	16·7	33·2
1914	20·5	18·6	26·3	36·4	43·8	51·1	57·5	55·7	45·0	40·0	27·5	11·0	36·1
1915	16·5	24·5	30·8	39·7	47·1	50·1	56·2	61·3	44·4	37·2	23·6	19·6	37·6
Means	15·6	18·6	25·7	35·8	44·9	51·2	56·6	55·5	45·7	37·2	25·4	17·5	35·8
GOLDEN—Elevation, 2,550 ft.													
1902	......	......	......	42·2	53·1	48·9	60·4	59·2	50·2	44·3	26·3	15·1	......
1903	17·6	14·7	22·0	40·9	50·9	61·1	59·9	59·2	43·6	41·8	26·4	22·8	38·4
1904	17·0	......	......	45·3	51·2	55·9	63·4	59·7	50·5	43·0	36·0	23·6	......
1905	15·6	10·8	39·0	43·4	50·6	56·6	63·9	......	51·7	35·9	29·4	23·9	......
1906	13·1	26·0	29·4	47·0	51·9	55·5	67·7	59·8	51·1	......	25·5	18·8	36·9
1907	-8·4	20·7	26·8	37·6	48·9	55·2	60·3	55·6	49·8	43·6	32·2	20·4	39·1
1908	15·5	15·3	28·6	41·2	51·5	56·7	62·4	59·3	51·4	39·8	33·1	14·9	36·9
1909	2·2	20·3	31·4	37·0	47·9	56·5	60·4	57·5	52·9	40·5	27·2	8·5	38·7
1910	12·3	6·9	35·2	44·3	51·0	54·7	60·9	56·0	50·1	42·2	28·6	22·3	35·8
1911	4·6	13·1	32·6	38·6	48·6	56·9	59·6	56·3	49·4	38·0	16·0	15·5	......
1912	6·9	23·8	25·3	44·2	52·0	61·7	......	56·8	47·6	37·8	29·9	20·5	38·2
1913	8·1	21·1	23·6	41·4	49·9	58·7	60·3	60·3	48·3	37·4	29·6	19·7	39·8
1914	20·5	20·1	30·8	44·4	50·5	56·7	63·4	59·5	50·5	43·4	30·3	8·4	......
1915	13·5	27·0	......	......	54·4	56·6	60·4	63·8	48·6	41·8	......	......	......
Means	11·0	18·3	29·5	42·1	50·9	56·6	61·8	58·7	49·7	40·7	28·5	18·0	38·8
HEDLEY—Elevation, 1,771 ft.													
1904	......	......	......	......	53·2	59·2	66·2	67·0	58·0	47·1	39·2	29·7	......
1905	26·1				......	......		......	56·5	39·6	33·8	29·1	......
1906	26·4	32·0	35·4	51·6	54·1	56·3	......	66·1	56·5	49·0	34·6	26·4	......
1907	6·4	25·6	33·6	42·2	54·4	......	68·8	62·8	56·7	50·2	36·6	29·3	......
1908	25·8	27·2	35·8	47·1	53·2	61·9	69·5	67·0	57·1	46·9	38·6	23·6	46·1
1909	10·9	31·2	39·9	45·2	53·3	60·8	64·3	65·3	61·1	45·4	34·0	23·6	44·6
1910	25·6	23·2	41·4	48·8	56·9	57·5	67·2	61·2	56·3	47·1	37·5	33·5	46·4
1911	17·5	27·5	40·2	44·7	51·1	60·7	68·6	64·2	53·9	46·5	28·3	26·1	44·1
1912	21·3	33·6	36·0	46·8	56·3	64·8	66·8	63·3	55·8	42·8	36·5	28·4	46·0
1913	18·2	21·3	33·0	47·6	53·8	61·3	66·8	66·8	56·6	43·7	36·6	30·0	44·0
1914	30·8	27·1	38·8	50·2	56·7	59·5	69·4	67·7	55·6	48·3	37·2	19·7	46·7
1915	23·3	34·5	43·3	52·2	55·3	61·2	66·1	71·4	56·1	47·5	30·5	26·7	47·3
Means	21·1	28·3	37·7	47·6	54·4	60·3	67·4	65·7	56·6	46·2	35·3	27·2	45·6
HEDLEY (NICKEL PLATE MINE)—Elevation, 4,500 ft.													
1904	......	20·1	23·5	37·5	41·5	46·9	55·1	56·9	48·7	40·8	32·9	23·1	......
1905	20·6	23·4	32·5	36·2	40·0	48·2	56·5	52·9	45·6	30·4	30·8	24·9	36·[illegible]
1906	24·4	27·0	24·7	39·6	41·6	44·4	63·0	55·4	46·2	37·7	27·9	22·9	37·[illegible]
1907	14·3	28·0	22·8	34·4	41·8	46·7	55·3	47·1	......	......	30·9	21·7	......
1908	20·5	23·0	25·0	34·2	37·9	45·4	56·8	57·6	46·9	......	......	20·8	......
1909	......	......	......	......	......	......	......	......	......	......	......	15·2	......
1910	13·2	11·9	28·7	30·2	39·2	38·1	51·1	47·6	43·2	36·5	22·4	22·0	32·[illegible]
1911	7·7	12·8	21·6	24·4	28·9	38·6	50·5	46·1	......	......	......	17·8	......
1912	18·2	22·8	20·9	30·7	40·5	50·3	50·5	48·0	41·7	30·6	24·8	23·0	33·[illegible]
1913	13·8	15·4	21·6	31·9	39·9	47·5	51·3	52·5	45·1	32·5	......	......	......
1914	20·0	23·2	29·6	36·6	43·7	46·8	56·2	53·7	42·5	41·5	28·2	15·9	36·[illegible]
1915	19·7	25·7	31·3	39·9	41·3	44·6	53·6	61·1	42·4	36·8	18·2	13·1	35·[illegible]
Means	17·2	21·2	25·7	34·1	39·7	45·2	54·5	52·6	44·7	35·8	27·0	20·0	34·[illegible]
HOLBERG and CAPE SCOTT—Elevation, near sea level													
1897	......	......	......	45·4	48·1	51·6	54·6	56·0	52·6	50·0	38·7	42·2	......
1898	38·9	39·1	39·7	42·8	47·4	52·4	55·6	55·4	53·0	47·0	41·5	38·5	46·[illegible]
1899	38·6	37·2	37·5	42·7	45·0	50·6	57·7	55·4	54·6	49·0	50·6	43·5	46·[illegible]
1900	43·3	39·4	44·7	......	......	......	......	......	......	......	......	......	......
1901	......	......	......	......	......	51·6	54·0	55·6	51·0	50·8	45·1	41·1	......
1902	38·6	41·2	39·5	49·1	49·2	52·6	54·3	55·3	49·8	47·9	41·7	36·9	46·[illegible]
1903	39·2	37·4	36·5	42·2	47·7	53·0	55·4	56·5	51·7	47·7	38·0	42·4	45·[illegible]
1904	39·5	35·1	36·2	45·0	48·8	51·2	53·8	53·0	51·1	49·4	46·3	40·4	45·[illegible]
1905	38·9	39·8	43·5	44·5	47·6	53·3	56·3	55·7	52·1	45·9	45·0	42·6	47·[illegible]
1906	39·4	40·7	45·8	45·9	48·8	52·3	55·6	55·4	51·2	49·2	43·8	39·2	47·[illegible]
1907	32·2	39·3	38·3	42·7	49·6	51·9	55·2	54·8	50·3	50·2	44·3	39·6	45·[illegible]
1908	37·9	37·6	41·1	43·0	47·0	52·3	54·2	53·4	50·0	46·3	43·6	37·7	45·[illegible]
1909	29·8	37·0	39·5	42·0	47·2	51·7	55·0	54·8	54·0	47·6	39·4	33·1	44·[illegible]
1910	33·3	33·9	39·7	40·9	49·1	49·7	56·5	56·7	54·6	47·7	40·9	41·5	45·[illegible]
1911	31·3	33·8	38·6	39·5	47·7	51·2	57·8	58·9	53·1	47·4	40·0	39·7	44·[illegible]
1912	37·0	41·3	41·1	44·4	52·0	54·7	59·7	59·2	56·3	47·6	42·8	39·4	47·[illegible]
1913	33·6	38·5	38·7	43·2	48·8	54·7	58·6	60·1	......	47·0	42·0	42·1	......
1914	37·8	39·7	43·6	47·7	52·8	54·1	58·5	61·4	54·8	54·2	44·7	36·2	48·[illegible]
1915	39·0	41·0	47·1	48·8	54·1	58·4	61·3	63·6	57·6	50·7	42·6	41·6	50·[illegible]
Means	36·9	38·4	41·8	44·1	48·9	52·6	56·4	56·7	52·8	48·8	42·8	39·9	46·[illegible]

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

IKEDA BAY—Elevation, 5 ft.

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1898	......	......	......	......	......	......	55·2	57·1	50·2	44·8	43·5	38·1	......
1899	28·6	35·5	39·1	41·7	46·0	50·6	53·6	53·9	51·9	46·3	38·0	36·2	43·5
1910	34·9	35·0	41·6	43·6	48·1	47·3	53·8	......	55·0	41·5	40·3	40·3	......
1911	......	......	......	......	48·3	52·7	57·6	61·0	57·1	47·8	40·6	......	......
1912	40·7	46·3	41·7	45·2	53·3	56·5	62·2	59·8	57·6	49·9	43·0	39·8	49·2
1913	34·8	39·6	43·3	43·5	45·3	47·2	......	......	......	49·1	43·5	42·9	......
1914	37·7	41·5	40·6	44·7	46·9	51·9	54·6	56·1	......	......	......	37·5	......
1915	36·3	39·8	43·6	47·4	53·3	53·4	56·9	60·4	56·6	46·7	39·1	37·7	47·6
Means	35·5	38·6	41·7	44·3	48·8	51·3	52·0	58·1	54·8	47·0	41·2	39·0	46·0

KAMLOOPS—Elevation, 1,245 ft.

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1887	......	......	......	......	......	......	......	......	......	46·0	35·7	27·8	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1890	11·2	......	......	......	......	......	68·4	67·9	59·6	46·5	40·7	35·9	......
1891	34·9	17·3	34·8	51·6	......	......	71·5	70·2	......	52·0	35·5	30·5	......
1892	21·6	28·4	44·4	47·2	......	67·2	67·4	68·9	60·4	43·8	33·1	21·6	......
1893	20·0	15·7	37·6	46·4	56·7	59·8	......	......	......	......	......	......	......
1895	......	......	......	......	......	62·5	68·0	66·8	51·1	45·2	38·0	29·7	......
1896	23·8	35·7	35·6	47·7	64·6	......	......	67·3	57·2	47·4	15·5	33·6	......
1897	26·4	28·8	28·3	51·6	62·0	65·6	66·8	70·7	58·7	48·2	26·0	25·3	46·5
1898	22·7	33·4	35·6	50·4	58·6	64·4	70·0	75·8	60·5	45·3	32·6	24·9	47·9
1899	24·9	21·9	34·0	46·8	53·6	62·2	69·1	62·5	58·2	45·6	46·0	32·0	46·4
1900	33·8	27·5	42·2	51·3	57·2	63·8	67·2	62·3	57·1	48·5	31·5	37·4	48·2
1901	22·8	25·7	42·6	48·3	60·3	60·8	67·1	72·0	57·3	52·1	41·2	31·3	48·5
1902	26·8	34·3	39·7	48·9	58·0	61·0	67·0	67·3	56·8	49·2	34·3	25·5	47·4
1903	28·1	26·3	30·3	47·0	57·4	68·6	67·3	65·7	53·1	46·5	35·5	32·2	46·5
1904	26·8	22·0	32·2	51·1	55·6	62·8	70·1	68·6	59·7	48·9	44·5	31·5	47·8
1905	27·1	25·2	45·4	50·9	57·4	65·5	72·4	69·2	57·5	41·2	35·4	30·5	48·1
1906	28·0	34·4	38·8	54·3	59·2	63·2	78·1	70·[illegible]	60·2	50·4	35·4	29·4	50·2
1907	3·7	25·8	35·9	48·4	61·5	64·2	70·8	64·9	59·1	50·0	41·6	31·9	46·5
1908	27·9	24·9	36·3	48·8	57·5	66·2	72·1	68·8	57·9	46·3	41·7	24·6	47·8
1909	9·5	29·4	43·4	47·1	57·4	66·2	69·2	66·7	62·0	47·7	35·8	21·3	46·3
1910	25·0	23·2	46·5	52·4	61·9	62·4	70·2	64·4	58·2	48·3	37·5	31·7	48·5
1911	11·2	22·7	39·5	45·7	55·6	64·1	70·0	66·0	56·1	48·0	26·3	27·1	44·2
1912	17·1	31·3	33·8	49·0	59·7	67·3	66·2	64·4	56·5	45·9	37·7	29·9	46·5
1913	14·3	17·3	32·3	49·4	57·3	63·8	67·4	68·3	58·4	44·7	37·2	32·4	45·2
1914	29·8	25·2	39·9	51·6	58·0	63·9	70·9	68·7	56·5	49·9	37·7	21·5	47·8
1915	23·3	36·8	45·2	55·9	58·5	63·3	68·6	71·6	56·8	50·3	33·3	29·6	49·4
Means	22·5	26·7	38·0	49·7	58·5	64·1	69·4	68·0	57·8	47·5	35·5	29·2	47·2

KELOWNA (OKANAGAN MISSION)—Elevation, 1,200 ft.

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1893	......	......	......	......	......	......	6·34	64·2	54·7		29·5	29·4	
1894	21·5	21·3	34·4	46·0	54·4	59·6	64·5	64·7	52·6	44·1	36·9	27·6	44·0
1895	21·7	33·3	37·7	46·5	52·7	57·6	62·5	61·0	48·6	41·3	33·6	25·9	43·6
1896	22·1	30·0	32·5	42·5	49·5	58·2	65·0	62·2	51·0	42·5	20·7	28·6	42·1
1897	24·6	27·5	27·3	48·7	58·3	62·0	61·0	......	......	......	......	......	......
1898	......	......	......	......	......	......	......	......	......	......	......	......	......
1899	......	......	36·7	44·3	51·5	59·7	66·0	61·5	56·1	44·3	42·4	30·8	......
1900	32·7	15·7	41·3	49·0	56·4	63·6	65·8	61·8	55·2	45·7	31·0	34·8	46·1
1901	23·3	25·7	39·7	44·5	55·1	56·9	64·8	67·5	......	......	......	......	......
1902	......	......	......	......	56·6	59·0	63·5	62·8	53·4	46·9	34·4	26·1	......
1903	27·9	22·9	28·3	44·2	55·3	65·9	63·6	63·8	51·8	44·8	34·6	32·0	44·6
1904	27·1	23·8	32·4	47·9	54·0	60·5	66·6	66·4	56·3	47·4	41·3	31·8	46·3
1905	27·8	19·6	42·1	48·0	54·8	62·3	68·6	66·8	56·4	41·4	35·2	31·7	46·2
1906	28·8	34·6	36·2	50·8	57·0	56·8	73·4	65·2	55·1	48·4	35·9	30·9	47·8
1907	10·0	27·5	33·2	44·4	56·6	60·6	67·0	61·7	55·9	48·0	39·5	32·7	44·8
1908	27·8	27·4	37·0	46·5	55·0	62·6	68·8	65·0	55·3	45·5	40·6	27·5	46·6
1909	12·8	30·8	39·0	45·0	54·4	63·4	66·1	63·5	59·7	48·4	36·9	25·6	45·5
1910	26·1	22·6	43·4	48·7	57·4	59·3	66·5	60·5	55·0	46·0	36·4	32·6	[illegible]
1911	17·4	21·1	37·0	44·8	54·1	61·1	67·0	63·5	54·0	44·4	28·5	26·6	[illegible]
1912	20·3	30·8	31·6	47·8	57·2	64·6	65·0	62·4	52·5	42·9	36·5	30·9	
1913	19·1	18·6	32·8	46·2	55·1	61·7	64·9	64·4	53·9	43·1	36·8	30·5	[illegible]
1914	31·3	27·2	39·4	48·7	55·1	62·6	68·6	63·7	54·1	48·2	39·5	26·0	[illegible]
1915	25·0	34·5	40·3	49·9	54·8	60·1	64·7	66·8	54·8	47·8	35·6	30·6	[illegible]
Means	23·6	26·1	36·0	46·8	55·0	60·9	65·8	63·8	54·2	45·3	35·3	29·6	45·2

LADNER—Elevation, near sea level

Year	Jan.	Feb.	Mar	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1898	36·5	43·0	40·8	47·4	55·7	58·3	62·0	63·1	57·8	49·0	41·4	37·3	49·4
1899	36·9	34·7	40·7	46·6	50·8	57·1	62·2	57·8	56·1	......	48·1	40·6	......
1900	39·6	37·0	44·5	48·0	54·3	58·4	60·9	58·8	......	......	......	......	......
1901	33·3	36·3	41·9	43·5	51·1	......	......	......	......	......	......	......	......
1902	......	......	......	......	......	......	......	59·3	52·6	48·0	40·8	36·0	......
1903	37·7	32·4	37·4	43·7	48·9	55·2	55·0	......	......	47·4	38·8	38·1	......

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
					LADNER—*Continued*								
1904	37·9	34·5	38·6	47·3	49·4	54·7	60·5	59·3	......	......	47·6	......	......
1905	36·9	36·7	45·9	47·6	52·3	59·2	62·4	60·0	52·8	43·4	43·1	38·4	48·2
1906	38·4	40·1	40·4	52·1	55·6	56·4	64·4	60·5	55·3	50·2	40·3	38·0	49·3
1907	20·0	36·4	36·5	44·2	53·6	58·9	63·1	58·1	54·8	51·2	44·2	39·2	46·7
1908	39·2	38·8	41·9	46·5	50·7	58·1	62·5	60·0	53·4	48·1	47·6	37·2	48·7
1909	29·4	40·0	45·8	46·8	49·0	57·2	59·6	58·2	57·0	51·4	44·1	33·1	47·6
1910	......	35·1	45·8	47·0	53·4	54·8	61·0	57·3	56·6	51·0	43·4	43·8	......
1911	34·2	37·8	45·0	45·1	54·2	55·9	63·5	59·3	54·3	49·6	41·5	40·8	48·4
1912	38·0	44·0	41·2	50·2	56·4	62·3	61·3	59·5	54·1	50·5	44·9	41·7	50·3
1913	34·9	35·8	40·5	46·3	......	......	62·7	62·0	55·6	49·6	43·5	39·9	......
1914	43·4	38·9	45·1	50·4	55·0	56·8	62·5	60·4	55·9	54·2	45·1	34·5	50·2
1915	39·2	43·9	48·9	52·9	56·3	62·3	62·5	61·3	55·6	49·3	41·7	40·8	51·2
Means	35·9	37·7	42·4	47·4	52·9	57·7	61·6	59·6	55·1	49·5	43·5	38·6	48·4
					MASSET—Elevation, 30 ft.								
1897	......	......	......	......	......	49·4	54·2	64·7	52·7	43·8	37·4	37·3	......
1898	38·2	37·2	37·9	38·3	42·1	52·4	59·8	61·8	......	......	43·5	34·[illegible]	......
1899	35·4	35·7	38·8	40·8	......	......	......	62·0	54·3	46·4	41·6	38·[illegible]	......
1900	39·2	38·9	41·4	42·1	48·7	54·3	57·8	57·4	54·4	45·1	40·3	45·3	47·1
1901	38·0	37·8	42·2	40·4	46·9	51·3	55·2	58·1	53·1	......	......	......	......
1902	39·3	40·4	39·5	41·4	50·8	55·0	56·3	57·6	51·2	45·3	40·9	36·7	46·2
1903	36·5	36·6	36·6	40·5	44·0	58·0	61·6	61·7	51·9	45·4	37·6	40·7	45·9
1904	36·0	31·8	34·0	44·1	44·6	49·6	50·6	55·8	54·4	18·8	42·8	42·4	44·6
1905	40·4	39·2	44·9	48·2	52·9	59·2	64·0	60·7	54·7	48·4	41·2	38·6	49·4
1906	37·8	40·8	42·3	46·6	53·7	56·1	65·7	60·6	53·0	47·7	41·3	38·4	48·7
1907	27·4	35·8	36·9	45·8	52·9	54·0	58·2	57·1	54·7	49·6	43·5	38·6	46·2
1908	37·6	35·5	39·7	44·4	57·3	53·3	59·4	58·0	50·7	45·0	42·8	39·0	46·9
1909	28·4	34·8	41·1	42·0	48·8	54·7	56·3	55·6	55·1	47·4	38·3	36·7	44·9
1910	36·7	35·8	......	43·9	48·9	51·2	57·8	59·7	56·0	46·7	39·1	40·3	......
1911	30·7	35·7	38·4	39·8	48·7	52·7	56·8	59·8	56·7	48·0	38·9	39·0	45·2
1912	37·1	40·6	40·2	45·0	52·8	51·6	57·7	57·2	53·4	45·9	40·0	39·4	46·7
1913	35·1	39·5	38·9	40·8	46·6	52·5	55·9	55·4	50·6	45·5	38·5	39·9	44·9
1914	34·6	39·4	40·4	44·4	48·5	53·0	56·6	54·4	50·0	48·8	40·4	35·5	45·5
1915	38·3	38·1	44·0	45·6	53·9	54·3	60·6	59·6	53·3	45·2	38·9	38·2	47·5
Means	35·9	37·4	39·9	43·0	49·6	53·5	58·0	58·8	53·3	46·6	40·4	38·8	46·3
					NANAIMO—Elevation, 125 ft.								
1892	37·7	40·4	46·7	45·1	56·4	60·2	60·2	66·5	58·0	49·2	42·4	......	......
1893	22·6	31·1	39·6	43·3	50·4	54·5	60·0	......	......	......	......	......	......
*	......	......	......	......	......	......	......	......	......	......	......	......	......
1901	......	......	42·4	45·4	52·7	54·9	59·6	65·3	56·0	52·1	44·4	39·7	......
1902	37·2	42·3	41·5	45·6	54·3	57·3	61·7	62·7	55·6	50·2	41·3	37·1	48·[illegible]
1903	38·4	36·1	38·5	44·8	51·7	59·7	61·7	61·4	54·8	48·9	41·1	40·5	48·[illegible]
1904	38·9	36·1	38·3	48·4	52·3	57·0	63·4	62·9	58·2	50·0	45·8	40·1	49·[illegible]
1905	36·7	37·9	45·6	48·3	53·0	60·9	64·6	61·2	56·0	44·9	42·7	40·2	49·[illegible]
1906	38·8	39·4	42·1	51·0	53·8	55·6	67·6	64·9	55·8	50·1	41·6	38·1	49·[illegible]
1907	29·1	39·0	40·2	46·7	55·9	58·8	65·1	62·1	58·4	50·2	43·4	38·4	48·[illegible]
1908	38·2	38·0	42·3	46·1	51·7	58·3	64·4	64·3	54·9	47·8	45·1	36·9	49·[illegible]
1909	30·1	38·9	41·3	46·0	50·2	58·1	59·2	59·2	56·9	48·6	40·9	34·0	46·[illegible]
1910	35·9	34·5	44·1	45·7	54·9	54·6	62·5	60·1	57·4	49·2	42·5	40·8	48·[illegible]
1911	33·6	37·6	42·4	44·0	51·9	56·4	64·7	......	......	48·9	39·9	40·2	......
1912	37·9	40·5	40·5	46·1	54·1	59·7	62·2	......	54·8	46·3	43·1	39·8	......
1913	35·0	37·4	39·1	......	......	......	61·9	62·6	54·5	46·5	40·2	38·5	......
1914	39·8	39·6	44·7	49·6	57·0	58·8	64·4	63·7	54·7	51·8	43·6	36·9	50·[illegible]
1915	37·7	41·9	46·5	51·0	55·3	61·0	65·1	66·3	58·3	51·0	41·4	39·8	51·[illegible]
Means	36·1	38·2	4·21	46·7	53·5	57·8	62·8	63·1	56·3	49·0	42·4	38·7	48·[illegible]

*No observations 1894 and 1895. Precipitation recorded 1896-1900.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
					NELSON—Elevation, 1,760 ft.								
1898	......	......	......	......	......	......	......	......	56·6	42·6	34·0	26·5	......
1899	27·4	23·5	33·8	43·5	50·9	58·9	67·0	59·3	58·7	44·4	......	......	......
1900	32·0	......	......	......	55·9	64·6	66·6	63·4	58·4	46·9	33·3	36·4	......
1901	27·3	29·3	40·5	45·7	56·0	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......
1904	28·2	30·5	32·4	48·2	53·3	59·2	65·9	64·0	55·7	46·3	41·0	31·3	46[illegible]
1905	28·1	25·2	40·2	46·7	53·5	61·2	66·6	65·6	56·7	41·7	36·3	32·0	46[illegible]
1906	34·8	33·3	35·5	50·5	54·9	59·0	71·2	64·9	56·7	48·6	34·3	32·4	48[illegible]
1907	17·9	31·8	36·6	43·3	53·9	......	65·5	60·9	56·7	48·7	38·6	32·5	......
1908	28·4	30·4	36·9	46·9	53·2	59·3	66·1	64·4	57·0	46·5	41·1	28·5	46[illegible]
1909	18·9	......	39·1	43·7	53·4	60·0	62·6	62·5	56·7	45·6	36·7	24·0	......
1910	27·0	25·5	41·7	49·7	53·3	58·6	65·8	60·1	57·9	46·0	38·5	28·6	46[illegible]
1911	16·1	26·3	39·1	44·7	50·8	60·3	66·3	63·6	54·2	45·0	30·6	27·6	43[illegible]
1912	22·9	32·2	35·2	47·9	57·3	64·5	62·0	61·1	52·9	42·5	36·3	30·2	45[illegible]
1913	20·9	23·2	32·9	46·1	54·2	60·8	64·6	64·3	54·9	42·3	34·9	29·7	44[illegible]
1914	30·1	28·3	39·1	48·5	55·0	58·5	68·8	68·6	53·1	46·1	37·5	23·6	46[illegible]
1915	25·1	30·4	41·1	50·3	53·8	63·6	65·5	70·4	54·2	45·3	32·3	27·4	46[illegible]
Means	25·7	28·5	37·5	46·9	53·9	60·7	66·1	63·8	56·1	45·3	36·1	29·3	4[illegible]

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—C[illegible]d

NEW WESTMINSTER—Elevation, 330 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1877..........	37·0	41·8	45·0	......	......	......	......	......	......	......	......	......	......
1878..........	41·6	42·9	47·1	49·1	56·0	61·1	62·0	63·4	53·4	46·7	43·7	34·8	50·3
1879..........	33·4	36·2	43·6	49·8	54·5	58·7	61·4	63·0	58·6	47·3	40·7	32·8	48·3
1880..........	30·9	33·6	38·6	47·6	51·7	58·3	61·9	61·0	56·2	48·1	37·1	32·6	46·5
1881..........	31·5	39·1	44·9	47·5	52·4	58·4	60·6	59·3	57·0	45·4	38·7	38·2	47·7
1882..........	33·1	33·7	......	......	......	......	62·3	62·5	56·8	47·1	39·7	39·0	......
....													
1888..........	27·9	41·0	40·6	49·7	58·4	61·6	63·4	66·4	61·1	51·6	43·9	41·9	50·6
1889..........	35·9	40·1	47·8	51·8	58·1	62·0	67·0	61·9	56·7	52·7	44·5	35·1	51·1
1890..........	......	......	42·2	......	57·0	58·9	63·3	64·2	57·9	48·7	44·6	43·3	......
....													
1894..........	......	......	......	......	......	59·2	65·4	67·5	56·8	47·7	42·7	34·6	......
1895..........	34·2	42·1	43·2	48·0	55·0	60·6	65·0	64·2	55·6	51·8	42·7	37·6	50·0
1896..........	37·6	41·2	41·2	46·1	52·6	60·5	65·4	64·4	56·5	51·3	31·1	39·7	48·9
1897..........	36·4	38·4	36·7	51·1	......	59·8	61·2	67·2	56·9	50·0	38·8	38·3	......
1898..........	35·7	41·1	40·4	47·4	56·1	60·2	64·3	66·6	60·5	49·8	40·5	36·5	49·9
1899..........	36·5	34·6	......	48·0	50·9	57·5	64·1	58·7	59·1	48·5	48·5	39·8	......
1900..........	40·4	37·4	46·8	49·9	54·1	59·7	62·4	60·0	56·1	48·8	39·0	41·3	49·7
1901..........	33·1	38·1	43·5	45·3	53·4	55·6	59·5	63·3	55·2	54·2	45·0	37·5	48·6
1902..........	35·4	41·8	41·8	47·5	55·2	57·8	61·7	61·9	55·9	50·8	40·5	36·3	48·9
1903..........	37·1	36·0	38·9	45·7	52·3	61·3	61·1	61·5	54·5	50·0	41·4	38·9	48·2
1904..........	36·6	35·1	39·5	50·9	52·4	57·7	63·3	62·1	57·5	51·6	47·0	39·6	49·4
1905..........	36·6	38·3	47·4	50·2	54·2	59·5	64·3	61·6	56·6	44·5	42·0	39·6	49·6
1906..........	38·4	40·8	43·6	50·9	54·6	57·6	67·1	63·3	55·9	50·6	40·7	38·2	50·1
1907..........	25·6	37·7	39·8	46·5	56·2	60·8	64·3	60·8	55·7	50·6	44·5	38·5	48·4
1908..........	37·3	38·1	41·6	47·4	51·0	58·6	63·9	62·0	55·0	48·4	45·1	35·3	48·7
1909..........	28·6	38·1	41·9	45·3	51·1	58·1	59·7	59·6	57·2	49·2	41·4	31·8	46·8
1910..........	34·7	33·3	44·8	46·8	55·2	56·1	62·3	59·7	58·1	49·9	42·1	39·5	48·5
1911..........	30·8	35·3	43·4	45·1	51·7	56·8	64·0	62·4	56·2	50·3	39·0	36·9	47·7
1912..........	35·5	40·0	42·2	47·2	56·8	60·9	64·1	62·0	57·5	47·7	42·3	37·4	49·5
1913..........	30·5	34·7	45·9	48·0	53·3	59·4	66·6	63·9	57·1	47·7	41·4	39·0	49·0
1914..........	38·8	37·7	44·7	50·6	57·4	59·3	64·0	63·5	55·0	53·1	43·2	35·1	50·2
1915..........	37·0	41·3	48·2	52·1	55·9	60·5	64·7	66·2	58·3	50·7	40·5	37·6	51·1
Means..........	34·8	38·3	43·0	48·4	54·4	59·2	63·3	62·8	56·9	49·5	41·7	37·6	49·2

NICOLA LAKE—Elevation, 2,120 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1896..........	20·4	34·4	30·6	42·1	48·3	56·8	65·4	62·8	52·5	43·9	12·9	29·7	41·6
1897..........	21·9	23·8	22·5	46·6	56·1	57·9	60·4	64·0	52·2	44·0	25·1	24·0	41·5
1898..........	20·8	30·7	32·1	44·3	52·2	58·0	63·4	68·1	54·4	41·7	29·6	21·7	43·1
1899..........	21·1	18·6	32·2	42·0	48·3	54·9	63·0	57·7	54·3	42·3	41·9	29·0	42·1
1900..........	31·6	24·6	39·4	46·5	52·0	59·1	62·1	56·9	51·5	44·2	27·6	31·6	44·2
1901..........	20·8	24·9	38·0	42·6	52·2	52·9	59·6	64·7	51·1	48·0	37·2	29·9	43·5
1902..........	23·9	29·0	34·1	43·8	52·7	53·9	60·0	60·6	51·9	45·3	30·5	20·1	42·2
1903..........	24·3	18·5	20·7	41·7	50·7	62·2	59·6	60·1	49·5	47·0	30·8	29·3	41·2
1904..........	24·6	19·5	26·5	45·4	51·8	56·8	62·8	62·2	54·9	46·2	40·8	28·9	43·4
1905..........	21·6	17·4	40·6	45·5	51·2	58·1	63·9	61·4	52·7	37·4	33·2	29·2	42·7
1906..........	27·9	31·4	34·5	48·6	51·6	55·2	69·1	62·1	50·8	45·2	32·1	27·4	44·7
1907..........	0·3	24·8	30·8	42·6	53·7	56·4	63·1	56·8	53·3	46·1	38·2	28·4	41·2
1908..........	22·8	21·4	31·9	44·1	50·2	59·4	63·6	61·8	52·3	43·8	39·7	23·1	42·8
1909..........	3·9	26·5	35·7	42·3	50·1	56·5	59·4	58·7	56·5	45·0	33·6	17·7	40·5
1910..........	20·4	17·3	40·4	45·8	53·4	54·3	61·7	58·1	52·4	45·7	35·4	32·2	43·1
1911..........	22·5	18·9	34·4	40·7	49·7	57·1	63·3	60·2	51·7	42·7	26·4	28·0	41·3
1912..........	16·2	30·8	30·1	43·9	52·5	60·5	60·5	59·2	50·1	41·6	35·1	28·3	42·4
1913..........	12·1	20·7	30·7	43·4	51·1	......	61·0	61·3	53·5	44·0	35·9	29·5	......
1914..........	26·0	22·2	35·3	45·6	51·4	55·8	63·5	63·5	51·2	45·8	34·8	17·6	42·8
1915..........	16·1	28·5	39·3	......	......	......	......	66·3	53·1	47·1	31·9	26·6	......
Means..........	20·0	23·7	33·0	44·1	51·6	57·0	62·4	61·3	52·4	44·3	32·6	26·8	42·4

NORTH NICOMEN (LOCH ERROCH)—Elevation, 59 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1893..........	31·[illegible]	28·9	42·5	45·2	[illegible]·6	55·6	64·9	64·1	53·9	47·1	37·9	38·3	47·0
1894..........	33·0	34·1	40·3	46·4	54·2	58·8	65·9	67·3	56·8	48·5	43·7	36·[illegible]	48·8
1895..........	33·3	42·9	43·5	49·7	54·2	60·5	65·6	63·6	53·9	54·0	44·4	38·2	50·3
1896..........	34·7	42·0	41·3	46·9	55·8	60·8	66·4	63·5	58·4	......	......	......	......
1897..........	25·4	39·6	37·1	51·9	58·0	60·1	61·9	67·7	56·2	50·[illegible]	38·1	36·4	49·4
1898..........	35·8	41·8	41·1	48·2	56·1	60·7	64·2	66·7	60·1	49·[illegible]	[illegible]0·1	36·9	50·1
1899..........	35·7	34·1	41·7	47·7	51·5	57·4	64·6	60·2	59·6	49·[illegible]	48·6	40·4	49·2
1900..........	40·9	37·9	48·0	51·0	54·8	60·2	63·6	61·0	57·1	49·6	39·8	41·6	50·5
1901..........	35·5	38·9	44·2	45·8	54·9	56·2	61·3	65·0	57·8	55·0	45·3	39·0	49·9
1902..........	36·1	42·1	42·5	48·5	56·1	59·0	61·9	63·0	57·4	52·0	40·2	35·2	49·5
1903..........	37·7	36·1	39·6	47·1	53·7	62·5	61·9	62·6	55·3	51·2	42·0	39·7	49·1
1904..........	37·8	34·8	40·2	51·5	53·7	58·6	64·3	63·2	59·2	52·8	48·1	40·1	50·4
1905..........	37·4	38·8	48·5	51·3	55·0	61·0	66·0	63·2	58·0	46·2	43·1	39·0	50·6
1906..........	38·2	42·7	44·8	52·4	55·1	58·6	69·4	65·0	57·6	51·7	41·2	38·6	51·3
1907..........	24·7	36·0	41·2	48·2	57·7	60·0	65·7	61·2	59·1	53·5	45·3	39·8	49·4
1908..........	37·9	37·9	42·6	48·9	52·7	59·7	65·7	63·9	55·8	49·6	46·6	36·3	49·8
1909..........	27·2	37·7	43·6	47·3	53·1	59·7	60·7	61·2	58·5	50·8	43·2	32·5	48·0
1910..........	34·6	32·9	46·2	48·7	56·6	57·3	63·5	60·5	59·3	51·1	42·2	40·4	49·4
1911..........	28·6	35·3	41·3	45·7	52·3	57·6	65·0	63·8	56·3	51·2	38·9	38·1	48·1
1912..........	32·5	43·1	41·8	48·2	56·3	60·9	64·1	62·6	57·7	47·8	43·1	39·4	49·8
1913..........	29·6	34·6	39·4	49·3	54·6	59·8	64·8	65·5	58·0	48·7	41·9	39·3	48·8
1914..........	38·6	38·1	46·0	52·0	58·8	59·9	64·7	64·4	55·2	53·5	44·1	34·6	50·8
1915..........	37·5	41·7	49·0	53·1	57·4	60·8	65·6	67·2	59·0	51·2	40·6	37·7	51·7
Means..........	34·5	38·0	43·0	48·9	55·0	59·4	64·5	63·8	57·4	50·7	42·6	38·1	49·7

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

PEMBERTON HATCHERY—Elevation, about 700 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1908	......	......	......	......	......	......	64·8	64·6	52·7	44·2	39·3	28·5	......
1909	15·0	29·2	36·4	42·6	50·8	58·9	61·4	60·2	54·0	46·6	34·0	23·1	42·8
1910	25·5	23·3	39·7	45·5	54·3	55·9	64·1	62·4	55·8	45·9	36·4	33·2	45·1
1911	18·1	28·7	39·4	43·5	52·1	57·6	65·3	63·1	54·0	45·6	29·5	29·7	43·8
1912	22·6	36·0	39·0	46·5	54·8	62·3	64·5	61·5	54·7	43·5	38·0	30·8	46·2
1913	19·7	27·0	......	44·7	51·7	58·2	62·8	62·5	......	49·0	34·8	32·2	......
1914	30·4	30·4	39·4	47·6	54·7	58·7	64·9	64·8	53·1	48·4	37·0	27·3	46·4
1915	28·0	35·7	42·7	50·0	55·1	61·1	66·2	66·7	55·9	47·3	34·4	28·9	47·7
Means	22·8	30·0	39·4	45·8	53·4	59·0	64·3	63·2	54·5	46·3	35·4	29·2	45·3

PENTICTON—Elevation, 1,150 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1907	......	......	......	42·0	......	......	67·8	63·3	57·8	52·2	41·4	35·1	......
1908	31·7	31·8	39·6	47·0	55·2	63·4	68·5	65·5	57·5	47·7	41·8	......	......
1909	17·9	33·6	40·0	47·2	54·0	61·6	64·6	63·6	58·6	46·8	38·1	26·4	46·0
1910	28·3	25·3	43·3	49·3	57·0	59·9	67·0	61·6	56·8	49·0	......	......	......
1911	......	......	38·4	44·9	53·9	60·9	66·3	64·0	55·9	46·7	33·7	30·5	......
1912	26·5	35·1	33·3	47·7	55·6	63·8	64·5	62·1	53·7	44·7	39·5	34·0	46·7
1913	22·6	23·9	34·8	48·0	54·6	61·8	65·5	66·0	56·8	45·0	38·9	33·3	45·9
1914	34·3	30·4	41·0	50·2	56·4	62·2	69·6	67·8	56·2	49·8	40·3	26·1	48·7
1915	26·8	36·4	42·7	52·6	56·4	62·2	65·8	70·2	57·0	50·7	33·5	31·3	49·0
Means	26·9	30·9	39·1	47·6	55·4	61·9	66·6	64·9	56·7	48·0	38·7	31·0	47·3

PILOT BAY—Elevation, 1,780 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1893	......	......	......	......	......	......	......	......	......	......	34·1	33·1	......
1894	26·3	28·2	35·9	44·0	52·8	58·94	68·0	67·2	54·3	46·5	39·8	30·3	46·0
1895	27·8	33·7	36·8	46·1	52·7	58·7	66·2	65·8	52·0	49·0	38·4	31·8	46·6
1896	29·7	35·4	35·4	44·5	51·1	62·6	69·7	65·5	......	......	......	......	......
1897	......	......	......	......	......	......	......	......	......	......	......	......	......
1898	......	......	......	......	53·5	60·1	66·0	71·5	58·0	44·5	36·2	29·2	......
1899	27·7	25·2	34·5	43·6	50·4	58·4	67·8	59·4	57·6	45·5	43·7	43·6	46·5
1900	34·2	28·0	40·3	48·6	55·4	63·0	65·8	61·9	57·7	47·7	34·6	......	......
1901	29·7	29·5	38·7	44·1	55·2	......	......	......	......	......	......	33·4	......
1902	28·3	33·7	37·4	45·3	54·0	57·7	63·8	66·8	57·0	50·2	36·6	30·8	46·8
1903	31·3	28·0	35·0	43·4	52·7	62·5	63·7	67·9	54·6	50·2	......	......	......
Means	29·4	30·2	36·8	44·9	53·1	60·6	66·4	65·7	55·9	47·7	37·6	33·2	46·8

PORT SIMPSON—Elevation, 26 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1886	......	......	......	......	......	51·8	56·5	56·5	53·1	47·1	40·8	38·4	......
1887	32·2	23·7	36·1	40·4	45·9	51·4	53·4	54·5	50·7	46·5	38·5	32·8	42·3
1888	25·1	38·0	38·7	41·8	48·3	53·9	55·1	57·1	55·1	47·5	39·8	37·4	44·8
1889	37·7	36·9	44·3	45·3	50·8	52·8	56·8	56·0	52·8	49·1	41·9	32·7	46·4
1890	27·5	30·2	38·6	38·8	49·5	53·9	56·3	57·3	54·1	47·3	45·6	35·8	44·6
1891	42·0	30·0	37·6	43·8	48·2	52·5	55·0	......	......	46·0	41·1	37·7	......
1892	36·3	37·0	40·9	38·6	......	......	57·0	57·0	52·9	48·5	37·2	36·1	......
1893	34·2	29·6	37·7	42·7	48·1	50·8	56·0	55·9	51·0	44·0	32·7	35·8	43·2
1894	30·3	32·5	36·0	39·2	45·9	50·9	55·4	56·9	51·2	43·9	40·9	30·6	42·8
1895	25·8	37·2	37·5	41·3	48·7	51·9	55·9	54·4	48·9	48·6	40·6	36·0	43·9
1896	28·6	35·4	35·9	40·4	48·3	51·9	58·1	57·8	53·5	47·9	28·2	39·9	43·8
1897	36·8	35·2	33·2	46·0	49·7	55·7	55·4	59·1	53·5	48·5	32·9	39·6	45·5
1898	35·8	34·8	38·9	44·0	51·3	55·7	56·5	60·5	55·7	47·5	38·5	38·0	46·4
1899	35·1	33·6	34·6	45·3	47·6	50·3	58·7	56·6	52·4	47·9	47·0	38·9	45·7
1900	40·5	37·0	41·6	46·3	49·5	53·6	57·8	56·7	53·6	45·6	39·3	41·6	46·9
1901	34·8	35·0	40·0	42·0	48·0	53·6	56·1	57·2	52·4	49·6	41·0	39·6	45·8
1902	38·3	41·5	38·8	45·6	50·9	55·5	57·7	57·0	51·1	46·9	36·9	32·2	46·0
1903	37·1	34·2	33·7	42·0	47·1	53·9	56·9	57·7	51·7	44·0	39·0	39·6	44·7
1904	34·8	28·5	34·0	43·4	45·9	50·1	53·5	55·5	51·6	48·1	43·9	39·7	44·0
1905	35·5	36·7	43·0	44·5	49·9	56·3	59·6	57·4	51·8	45·1	42·5	38·4	46·7
1906	33·0	38·4	40·4	45·0	50·6	53·3	58·8	57·0	51·1	48·0	41·0	33·8	45·9
1907	24·2	35·2	36·1	42·9	51·3	53·7	57·6	55·8	53·5	46·8	41·4	38·0	44·7
1908	35·7	34·9	......	41·0	45·5	51·0	54·5	53·5	49·1	43·4	40·5	36·2	......
1909	24·0	32·1	38·4	40·1	46·6	52·1	54·5	58·7	52·1	45·1	30·3	30·9	42·1
1910	33·1	30·3	38·8	40·4	47·7	48·9	......	......	......	......	......	......	......
Means	33·3	34·1	38·0	42·5	48·5	52·7	56·4	56·8	52·3	46·8	39·2	36·6	44·7

PRINCE RUPERT—Elevation, 170 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1909	23·2	32·9	39·0	40·2	46·6	51·8	54·7	53·6	53·6	46·1	36·8	31·6	42·5
1910	33·1	32·8	......	......	......	......	54·8	55·1	50·8	46·7	38·9	39·8	......
1911	26·1	34·5	37·0	38·1	46·0	48·9	56·4	57·0	55·4	48·4	37·0	37·0	43·4
1912	34·5	41·6	40·7	43·1	52·3	52·6	57·5	55·1	54·8	48·0	41·1	38·9	46·7
1913	29·7	37·4	37·4	43·3	48·7	56·0	56·2	58·0	53·3	45·1	42·6	41·3	45·8
1914	35·7	40·5	42·9	46·8	49·8	54·8	54·9	56·2	51·8	51·5	41·0	35·1	46·7
1915	41·2	39·9	46·3	45·4	53·0	54·0	58·0	60·2	54·7	46·6	39·0	37·7	48·0
Means	31·9	37·1	40·5	42·8	49·4	53·0	56·1	56·4	53·5	47·5	39·5	37·4	45·4

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

PRINCETON—Elevation, 2,111 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1893							63·0	62·5	64·2	37·5	24·2	23·7	....
1894	....	17·8	30·7	43·8	50·6	55·3	61·3	61·6	51·3	42·7	35·5	18·0	....
1895	16·5	31·8	37·8	46·8	54·7	57·0	60·7	63·4	52·1	43·4	37·0	24·1	43·9
1896	19·3	28·2	35·8	....	....	55·3	65·2	63·6	53·3	44·8	22·8	....	....
1897	20·0	22·7	22·6	45·8	55·5	53·6	61·8	68·0	52·0	48·9	....	22·8	....
1898	16·5	31·3	31·3	....	....	....	63·6	66·9	54·6	42·7	30·8	16·0	....
1899	18·8	....	32·2	....	....	....	....	....	....	....	....	....	....
1900	....	....	....	....	....	....	....	....	....	....	....	....	....
1901	18·8	25·9	39·8	43·0	53·3	54·2	61·9	65·2	5·22	47·9	35·8	24·7	43·6
1902	19·7	27·7	33·8	43·8	52·0	54·8	60·3	60·7	52·1	45·6	28·6	15·6	41·2
1903	17·6	15·1	24·8	40·3	49·7	62·0	60·3	61·3	50·8	44·6	30·2	26·1	40·2
1904	20·7	19·4	28·7	45·8	49·8	57·0	63·8	63·9	56·2	45·0	36·6	24·5	42·6
1905	18·9	17·8	39·1	45·6	51·2	58·4	64·9	61·7	54·4	37·6	31·6	27·0	42·4
1906	21·1	29·2	34·0	47·6	53·2	55·7	69·4	63·3	54·4	45·0	30·9	22·0	43·8
1907	−0·6	24·8	29·9	41·3	53·0	56·6	63·4	58·4	55·0	47·4	33·7	24·0	40·6
1908	18·1	22·2	32·0	44·2	50·1	57·6	64·9	60·9	52·3	42·8	35·2	17·6	41·5
1909	2·2	25·1	33·0	40·5	48·6	56·3	60·6	59·2	55·4	40·2	29·9	17·9	39·0
1910	17·2	13·8	36·8	45·7	53·5	55·1	61·9	58·2	53·9	44·1	32·4	25·9	41·5
1911	10·5	17·8	34·6	41·4	49·3	56·6	63·6	60·6	51·9	43·1	24·3	21·8	39·6
1912	15·6	27·9	28·9	44·6	53·5	60·7	62·1	59·5	51·8	53·5	32·2	23·1	42·8
1913	11·4	16·1	30·4	43·4	51·0	57·9	61·6	62·6	51·9	39·7	31·7	24·1	40·2
1914	24·5	23·9	35·5	46·8	52·6	56·9	64·6	62·1	51·4	45·5	33·6	15·6	42·8
1915	16·5	28·9	40·2	49·0	52·4	58·2	62·9	65·7	52·9	45·0	26·5	19·3	43·1
Means	16·1	23·4	33·0	44 4	51·8	56·8	62·9	62·4	53·6	44·2	31·2	21·7	41·8

QUATSINO—Elevation, near sea level

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1895							56·9	59·0	49·9	48·8	43·7	39·0	....
1896	36·0	39·5	37·0	41·0	46·9	51·0	58·5	58·4	53·2	48·5	33·9	41·0	45·4
1897	38·9	38·3	35·3	45·8	49·2	53·8	55·7	59·6	53·3	49·0	37·7	41·5	46·5
1898	37·8	38·5	39·8	43·2	49·5	54·1	57·2	60·4	55·3	48·1	41·0	37·6	46·9
1899	38·4	37·7	37·9	42·3	46·5	51·6	59·4	56·9	55·0	47·1	47·9	42·9	47·0
1900	....	....	43·7	44·3	49·6	54·9	59·2	57·4	54·6	47·2	40·6	44·1	....
1901	37·2	37·1	41·3	....	....	....	54·3	59·2	53·4	51·9	40·8	40·9	....
1902	38·6	41·3	39·3	45·1	50·5	53·7	56·7	58·6	53·1	49·7	42·6	37·8	47·5
1903	39·0	35·1	36·8	42·2	46·6	55·8	57·6	57·9	52·1	48·7	40·7	41·8	46·2
1904	....	35·5	37·8	45·9	47·9	52·5	55·3	56·0	53·3	50·5	45·9	40·3	....
1905	36·7	38·3	43·5	44·9	48·6	54·3	58·2	56·7	53·0	45·8	44·2	41·8	47·2
1906	37·9	40·0	41·1	45·1	49·8	53·4	59·6	58·0	52·6	49·5	42·6	38·3	47·3
1907	....	....	....	....	....	55·0	59·0	57·8	....	....	....	....	....
1908	....	....	....	....	48·8	53·3	58·1	58·1	52·9	48·5	44·6	38·0	....
1909	30·0	37·0	39·9	43·2	47·2	51·5	56·1	54·4	....	....	41·2	35·2	....
1910	35·9	35·9	42·1	42·3	50·4	50·9	56·5	56·2	54·2	48·8	42·2	42·6	46·5
1911	....	36·1	41·2	41·0	46·7	50·9	57·8	57·9	51·2	....	42·8	40·3	....
1912	38·9	41·6	40·2	45·1	51·8	56·0	59·6	58·2	53·4	46·7	43·1	40·1	47·8
1913	33·7	38·7	40·8	....	49·5	54·6	58·1	58·3	52·9	45·4	41·8	42·3	....
1914	37·7	39·8	42·9	47·6	51·7	54·5	59·0	59·2	52·9	51·6	43·4	35·8	48·0
1915	38·5	40·4	46·2	49·2	54·5	58·0	60·1	61·8	56·4	49·8	39·9	38·3	49·4
Means	39·1	40·6	42·5	44·2	49·1	53·7	57·9	58·1	53·3	48·6	42·1	40·0	47·4

QUESNEL—Elevation, 1,700 ft.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1893	....	11·5	26·5	39·1	51·9	53·5	60·7	60·8	52·1	39·7	19·3	15·3	....
1894	....		29·4	41·1	51·1	58·0	63·5	....	....	37·3	27·5	22·8	....
1895	8·3	21·1	32·1	42·8	46·2	57·5	60·3	58·3	44·5	43·0	38·0	20·8	39·4
1896	9·6		35·5	39·4	47·9	57·2	64·2	....		....	−4·1	24·3	....
1897	12·9	20·9	15·5	45·8	53·8	62·1	58·8	61·8	51·6	45·9	....	21·3	....
1898	....			42·4	....			64·5	53·8	40·2	26·0	17·8	....
1899	22·5	16·5	23·8	40·4	47·6	56·3	63·4	58·3	52·1	37·5	41·2	29·3	40·7
1900	24·6	20·6	31·0	44·8	52·7	56·4	61·1	57·5	52·1	44·0	32·6	38·0	43·0
1901	20·7	21·2	37·4	45·5	54·2	56·1	60·4	60·0	56·5	....	41·0	31·9	....
1902	26·9	....	....	....	....	....	....	60·0	52·9	50·3	26·2	19·5	....
1903	21·8	27·1	....	....	....	64·1	64·1	61·3	50·2	46·5	30·4	29·6	....
1904	18·5	8·3	19·5	47·6	50·2	58·3	62·6	61·6	54·5	45·2	40·3	23·5	40·8
1905	15·4	15·8	41·0	45·6	53·9	60·6	66·7	60·5	53·4	40·1	32·3	26·5	42·6
1906	15·6	25·2	33·4	47·1	55·3	57·2	68·6	63·1	51·9	45·7	32·4	14·2	42·5
1907	−9·8	18·0	27·2	40·8	54·4	57·8	63·8	58·4	53·4	46·1	34·5	25·3	39·2
1908	20·5	19·2	28·8	40·4	50·9	56·0	61·2	59·0	48·9	39·2	34·3	18·2	39·7
1909	−3·5	14·8	33·8	38·4	48·3	58·5	60·2	56·4	53·5	42·1	20·2	22·9	37·1
1910	17·3	13·7	36·5	42·2	51·8	54·8	59·8	58·3	49·9	39·8	29·4	22·4	39·7
1911	3·3	12·5	32·4	37·1	50·2	55·1	60·5	60·1	53·5	41·7	20·4	21·5	37·3
1912	8·2	28·6	23·8	43·2	55·0	59·3	61·0	60·2	52·1	40·9	31·9	23·0	40·6
1913	8·0	15·5	24·5	42·0	51·1	59·7	59·8	61·6	49·0	39·6	32·4	28·9	39·3
1914	20·0	22·0	33·9	44·4	52·1	59·7	58·0	61·7	52·4	45·2	32·9	13·2	41·3
1915	17·6	28·5	39·9	49·2	54·5	59·8	64·5	66·9	53·4	42·5	21·1	23·1	43·4
Means	13·9	19·0	30·3	42·8	51·6	58·0	61·6	60·5	52·0	42·5	29·0	23·2	40·4

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
						QUESNEL FORKS (BULLION)—Elevation, 2,275 ft.							
1897	...	...	...	...	...	57·6	56·3	61·3	50·4	43·0	15·4	24·3	...
1898	22·1	23·9	25·9	23·4	52·0	56·7	60·2	65·4	53·6	40·2	26·3	20·6	39·2
1899	20·5	15·9	22·7	37·2	45·1	52·9	61·0	55·5	52·8	38·8	41·4	25·9	39·1
1900	26·8	22·3	31·6	44·6	50·6	57·6	59·5	54·7	49·6	39·9	27·2	33·5	41·5
1901	18·4	21·7	34·2	37·8	50·4	[illegible]	57·4	60·5	48·9	49·4	36·7	28·4	41·4
1902	21·0	30·4	28·4	38·6	50·5	52·7	58·0	55·4	46·4	42·9	26·0	15·5	38·8
1903	19·7	22·1	19·7	36·5	45·7	58·3	56·1	55·2	43·9	41·0	28·6	27·5	37·9
1904	18·5	8·0	20·9	43·9	46·6	[illegible]	60·1	57·5	50·0	43·7	38·9	25·1	39·0
1905	16·1	19·6	37·6	41·5	49·6	55·5	61·4	56·4	49·9	35·5	32·2	27·5	40·2
1906	18·3	25·6	30·2	43·8	51·0	53·4	65·5	56·7	48·0	41·6	29·7	17·4	40·1
Means	20·2	21·1	27·9	38·6	49·1	55·1	59·6	57·9	49·3	41·6	30·2	24·6	39·6
						REVELSTOKE—Elevation, 1,476 ft.							
1898	...	...	...	...	54·6	60·6	65·9	69·2	56·2	43·7	33·2	22·7	...
1899	22·7	...	31·5	40·7	49·3	58·3	...	...	...	41·2	...	28·3	...
1900	30·2	22·9	36·4	47·1	54·2	...	...	...	...	...	...	...	...
1901	...	...	...	...	...	...	...	...	...	...	...	...	...
1902	...	...	...	36·5	47·0	50·2	56·7	57·4	49·5	45·4	36·7	29·3	...
1903	...	19·4	25·9	39·2	49·6	61·7	...	...	47·4	41·6	30·7	29·9	...
1904	25·7	19·7	29·6	44·0	49·9	56·8	65·0	63·9	53·6	44·5	38·6	30·8	43·5
1905	24·2	18·3	37·5	45·2	50·9	58·0	64·8	61·8	53·1	38·6	34·3	30·2	43·1
1906	25·7	29·3	32·4	46·8	54·0	56·1	68·6	61·6	53·0	44·6	31·5	26·8	44·2
1907	4·2	25·6	31·8	39·0	52·5	57·8	63·6	57·9	52·9	46·2	37·0	29·8	41·6
1908	26·3	25·1	33·5	43·2	52·1	59·7	64·5	63·6	52·7	43·1	38·0	22·8	43·7
1909	9·5	27·1	35·2	40·5	51·6	58·2	63·2	59·3	56·1	44·3	32·7	14·9	41·1
1910	22·0	16·7	38·6	44·9	54·0	57·7	63·9	59·8	54·9	44·7	33·5	30·7	43·4
1911	14·2	20·4	34·2	41·1	50·6	60·2	61·0	59·3	52·8	42·6	25·7	25·6	40·6
1912	17·0	31·1	31·2	45·4	55·9	63·9	62·2	60·9	52·0	41·0	34·5	29·3	43·7
1913	16·9	19·6	29·3	44·2	44·8	61·6	63·4	63·5	53·4	42·3	33·2	25·1	41·4
1914	27·8	24·8	33·0	44·9	53·5	58·6	65·1	62·4	52·7	45·2	35·4	18·8	43·6
1915	20·5	32·1	39·1	48·6	55·1	58·0	63·0	66·2	51·9	44·2	32·0	26·5	44·8
Means	20·5	23·7	33·3	43·3	55·0	62·5	63·6	62·0	52·8	43·4	33·8	26·4	43·4
						RIVERS INLET—Elevation, 20 ft.							
1894	31·9	32·8	37·2	40·3	49·2	53·5	58·5	60·9	51·4	44·5	40·2	33·3	44·5
1895	31·3	38·0	39·0	43·5	50·8	55·4	59·1	57·8	49·8	50·0	41·7	36·5	46·1
1896	30·4	30·7	37·4	43·2	49·5	53·2	61·5	60·8	55·3	47·9	31·2	39·3	45·0
1897	37·0	36·4	35·3	45·4	50·1	54·5	55·3	60·0	53·6	49·0	35·9	39·0	45·9
1898	36·6	38·0	39·0	43·8	52·0	55·5	58·4	60·3	55·1	46·8	38·3	36·9	46·7
1899	35·1	34·6	37·7	42·7	48·5	52·6	61·8	57·6	55·5	45·8	46·6	38·8	46·5
1900	38·5	36·3	43·4	45·6	49·5	56·4	59·3	58·5	54·8	45·8	38·7	41·6	47·4
1901	32·5	36·4	40·1	42·4	49·1	53·1	55·7	58·3	53·9	52·0	43·1	37·0	46·1
1902	35·3	40·6	38·3	45·6	51·9	55·0	57·5	57·8	51·8	49·0	37·6	33·6	46·2
1903	36·4	34·7	35·6	42·6	48·2	55·7	57·6	58·9	51·5	47·2	38·0	40·0	45·5
1904	34·6	30·1	35·4	46·1	47·9	52·0	56·5	57·5	53·9	49·1	44·5	38·3	45·5
1905	35·8	36·0	44·1	46·1	50·1	56·5	60·4	56·9	51·6	43·9	41·1	38·4	46·9
1906	34·7	40·7	41·6	45·6	51·3	53·4	58·9	58·4	51·3	47·3	40·3	34·2	46·5
Means	34·6	35·8	38·8	44·1	49·9	54·4	58·5	58·7	53·1	47·[illegible]	39·8	37·5	46·2
						ROSSLAND—Elevation, 3,400 ft.							
1900	28·6	23·2	39·2	48·4	52·7	60·2	62·9	58·5	54·6	41·7	30·3	32·0	44·4
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1905	24·9	23·4	38·7	44·4	49·0	55·4	63·7	61·7	53·6	37·4	31·5	26·3	42·5
1906	25·9	28·4	31·3	48·0	49·3	53·8	68·4	61·7	54·1	44·8	29·6	27·1	43·4
1907	13·7	28·2	31·1	39·3	51·9	56·1	62·3	55·7	51·6	47·4	34·1	26·6	41·5
1908	24·5	25·7	32·4	42·3	48·2	55·9	63·8	60·5	53·4	42·6	37·0	22·3	42·4
1909	14·7	27·5	33·1	38·9	48·2	61·7	59·7	59·5	55·1	42·9	32·9	19·6	41·2
1910	22·3	20·5	38·3	47·1	54·6	56·3	65·8	59·3	54·5	4[illegible]·1	32·8	29·0	43·7
1911	20·5	24·3	36·7	42·1	48·1	58·3	64·1	60·4	50·8	41·9	27·4	23·8	41·6
1912	21·0	31·0	...	43·1	52·4	61·4	60·3	58·0	50·2	38·6	32·9	26·5	...
1913	19·3	19·9	29·7	41·8	50·3	57·4	61·2	62·6	53·5	39·1	32·5	26·0	41·2
1914	28·8	25·6	35·4	44·6	51·8	55·4	66·4	65·5	51·4	44·9	34·2	20·4	43·7
1915	22·8	32·2	38·6	49·4	51·4	55·2	61·0	68·2	52·2	43·9	29·7	24·0	44·0
Means	22·3	25·9	35·0	44·1	50·7	[illegible]	63·3	[illegible]·0	52·9	42·4	32·1	25·3	42·7
						SALMON ARM—Elevation, 1,150 ft.							
1893	...	...	...	43·0	52·4	54·5	62·5	62·9	54·2	41·4	28·1	27·2	...
1894	21·0	22·6	34·2	45·0	53·5	58·3	64·7	62·6	51·2	42·8	35·8	27·6	43·3
1895	19·4	28·5	37·3	46·4	51·2	58·3	62·4	62·1	48·2	42·7	34·9	29·1	43·4
1896	22·4	[illegible]	33·8	45·3	51·7	58·7	64·6	62·1	52·3	43·6	19·2	32·4	43·2
1897	24·1		38·6	47·3	...	...	...	...	...	...	...	...	...
...	...		...	...	...	...	...	...	...	...	...	...	...
1906	...		...	...	56·3	59·5	74·2	66·9	56·5	47·9	35·8	31·0	...
1907	8·8	26·6	33·3	44·5	57·4	61·6	67·0	60·8	57·4	49·1	40·1	31·5	44·8
1908	29·0	31·8	36·6	46·9	56·4	63·6	69·0	65·5	55·3	45·1	40·3	27·5	47·2

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
SALMON ARM—*Continued*													
1909	12·4	28·9	37·3	44·3	53·8	62·1	63·5	64·5	58·6	46·9	37·5	22·9	44·6
1910	24·8	23·1	42·7	49·8	58·2	59·6	63·5	62·3	56·1	44·0	35·7	31·3	46·3
1911	8·9	21·2	33·3	44·6	53·9	61·0	64·5	63·0	53·8	44·3	27·2	26·2	42·2
1912	20·7	24·1	31·0	46·9	57·5	65·5	64·3	61·6	52·4	44·0	36·3	29·6	41·3
1913	16·0	16·8	30·3	45·8	54·1	60·0	64·8	64·8	54·3	42·5	35·1	29·7	42·4
1914	30·2	26·2	37·9	48·7	55·1	61·4	67·0	64·8	54·0	47·6	37·2	23·2	46·1
1915	22·1	32·7	42·1	50·7	55·2	58·8	64·1	69·5	[illegible]	47·9	32·9	27·8	46·7
Means	20·0	[illegible]	35·4	46·4	54·7	60·2	64·0	63·8	54·3	45·0	34·0	28·4	44·5
STEVESTON (GARRY POINT)—Elevation, 6 ft.													
1896	......	40·5	[illegible]	[illegible]	50·6	56·8	61·4	60·1	52·7	[illegible]	33·0	41·7	......
1897	37·2	38·9	[illegible]	47·8	54·2	58·9	50·8	62·3	54·3	[illegible]	39·5	39·2	48·0
1898	36·9	41·9	39·4	46·4	52·9	57·7	60·2	61·4	56·0	48·2	40·5	37·3	48·2
1899	35·6	34·6	39·9	45·6	48·4	55·0	61·9	57·0	54·3	47·0	48·6	40·6	47·3
1900	40·3	37·5	44·7	48·1	53·5	57·5	68·0	58·6	53·3	47·7	38·1	41·5	48·5
1901	34·6	38·3	42·9	44·6	52·7	54·9	58·3	60·2	53·1	51·1	43·0	38·3	47·8
1902	35·2	41·9	42·1	46·0	53·6	56·4	59·2	59·3	52·5	48·3	41·4	37·9	47·8
1903	37·8	34·5	37·6	44·5	51·2	57·5	58·9	58·8	53·0	47·5	41·2	38·9	46·8
1904	37·0	36·2	38·9	47·9	51·5	55·4	60·0	58·0	54·1	49·2	45·8	40·2	47·9
1905	36·9	37·1	45·2	47·6	52·1	57·7	61·3	58·9	54·7	43·9	40·9	39·3	48·0
1906	38·9	39·6	41·4	49·0	52·5	56·1	63·4	60·1	54·5	49·1	41·1	38·1	[illegible]
1907	26·3	37·5	39·5	44·9	53·3	55·0	61·2	57·2	54·0	49·9	45·5	39·6	47·0
1908	38·6	38·4	41·9	46·6	51·7	56·9	61·8	59·8	52·7	48·0	46·8	36·5	48·3
1909	29·3	39·1	41·2	45·6	50·9	56·9	59·1	57·2	54·9	48·6	42·6	33·4	46·5
1910	35·4	33·4	43·4	45·9	53·6	55·4	59·8	56·7	54·4	49·0	42·2	40·8	
1911	31·6	35·8	40·9	43·1	50·9	55·6	61·6	59·0	53·9	46·8	39·3	30·8	
1912	36·1	39·8	38·5	46·2	53·2	57·8	60·7	59·4	53·5	46·2	43·1	39·2	47·8
1913	32·0	30·4	39·0	46·6	52·1	57·7	60·8	61·2	52·9	43·7	40·9	38·4	46·5
1914	40·7	38·0	42·6	47·8	53·1	57·1	61·6	58·8	53·8	50·6	43·8	34·2	48·5
1915	[illegible]	41·0	45·3	50·2	54·2	59·2	62·2	63·0	55·5	49·7	40·6	39·2	49·3
Means	35·7	37·8	41·0	46·5	52·3	56·7	60·6	59·4	53·8	48·2	42·0	38·7	47·7
SUMMERLAND—Elevation, 1,100 ft.													
1907	......	......	......	......	......	......	69·8	62·2	57·1	49·2	37·3	29·8	......
1908	26·6	26·5	36·3	47·5	54·4	63·4	70·8	67·9	57	45·8	39·9	25·1	46·8
1909	12·4	30·4	39·5	44·7	53·6	62·3	65·9	65·3	60·9	46·8	36·3	23·0	45·1
1910	24·0	21·9	41·6	49·3	59·0	59·8	69·5	63·0	57·2	46·8	35·8	30·6	46·7
1911	17·3	23·0	38·3	44·9	53·1	62·0	68·7	65·6	54·6	45·3	29·0	27·3	44·2
1912	21·5	31·0	34·4	47·3	57·1	65·5	66·1	62·4	54·2	43·3	36·3	28·8	45·7
1913	18·4	21·0	32·2	46·0	54·8	62·5	60·8	66·3	55·9	43·2	36·2	29·6	43·9
1914	30·0	25·5	38·3	49·2	56·2	60·0	69·6	68·6	54·7	47·8	37·3	21·5	46·5
1915	22·2	33·3	41·4	52·1	55·0	62·0	65·8	71·3	56·5	47·9	31·9	28·1	47·3
Means	21·6	26·6	38·0	47·6	55·4	62·2	67·4	65·9	56·4	46·3	35·5	27·1	45·8
SWANSON BAY—Elevation, near sea level													
1908	......	......	......	......	......		......	58·6	50·4	45·8	43·0	36·0	......
1909	25·0	31·7	38·3	39·9	45·9	53·1	55·0	54·0	53·1	45·2	35·9	30·3	42·3
1910	32·1	28·8	37·5	38·0	44·7	48·2	55·2	56·2	54·8	45·3	37·9	35·1	42·8
1911	23·8	28·9	35·3	37·1	45·1	49·9	59·2	59·5	54·8	48·6	35·5	36·1	42·8
1912	32·1	38·3	39·7	42·9	51·3	54·8	60·3	57·3	54·5	46·3	39·5	37·0	46·2
1913	28·0	34·1	34·9	40·2	47·3	56·1	......	......	......	......	......	......	......
Means	28·2	32·4	37·1	39·6	46·9	52·4	57·4	57·1	53·5	46·2	38·4	34·9	43·7
VANCOUVER—Elevation, 136 ft.													
1898	......	......	......	......	......	......	......	......	......	49·8	42·5	38·7	......
1899	37·4	36·4	41·8	47·9	51·5	......	65·1	......	......	......	......	......	......
1900	40·8	37·3	45·7	49·2	54·3	59·0	62·0	60·3	55·6	49·0	39·5	42·7	49·6
1901	34·2	38·0	43·0	45·0	52·9	55·7	60·7	62·5	54·3	53·0	44·4	37·9	48·5
1902	34·9	42·2	42·8	45·4	53·8	58·2	62·4	62·6	54·7	50·4	40·6	38·1	48·7
1903	38·9	36·0	39·4	46·4	52·9	61·3	62·5	62·3	54·6	50·3	41·6	[illegible]	48·9
1904	37·6	36·6	......	......	......	......	......	......	......	......	......	......	......
1905	......	......	......	[illegible]	53·0	59·4	64·1	60·9	56·0	44·2	41·5	39·6	......
1906	38·7	39·8	42·7	49·8	53·9	56·9	66·1	62·3	55·7	50·2	40·8	38·6	49·6
1907	27·3	37·6	39·4	45·6	55·6	58·9	63·7	60·7	57·1	50·4	44·6	39·4	48·3
1908	38·1	38·4	41·6	46·6	51·2	58·0	63·5	61·9	54·1	47·9	45·5	36·1	48·6
1909	29·2	39·2	41·4	45·0	51·4	58·2	60·5	59·6	56·5	49·6	42·4	33·9	47·2
1910	36·3	24·6	44·5	47·2	56·0	57·1	62·8	59·8	57·5	50·4	42·8	41·0	48·3
1911	32·6	36·6	42·9	44·9	52·2	57·2	64·0	62·0	56·1	49·8	39·9	38·7	48·1
1912	37·4	40·9	41·3	48·0	56·1	60·5	63·6	61·6	56·6	48·2	43·8	39·4	49·8
1913	32·5	36·1	40·1	48·9	54·2	59·2	62·9	62·8	55·5	47·6	42·4	40·1	48·5
1914	40·5	38·7	44·9	50·6	56·4	58·7	63·5	61·8	54·8	52·5	44·5	36·4	50·3
1915	38·2	42·5	47·7	52·3	56·2	60·4	64·7	65·6	57·9	50·9	41·7	39·0	51·4
Means	35·9	37·5	42·6	47·5	53·9	[illegible]	63·3	61·8	55·8	49·7	42·4	38·8	49·0

TEMPERATURE RECORDS FOR SELECTED STATIONS IN BRITISH COLUMBIA—*Continued*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
VERNON—Elevation, 1,575 ft.													
1893	21·1	17·0	32·2	43·1	53·8	54·0	62·6	64·0	55·5	41·3	.....	.....	.....
1894	.....	.....	.....	.....	.....	.....	.....	.....	.....				
1895	22·0	23·0	38·2	48·1	53·1	59·5	63·7	62·2	61·2	41·4	35·0	28·2	45·5
1896	20·1	32·3	35·2	38·2	51·7	58·9	67·4	64·3	53·2	44·6	20·1	30·2	43·0
1897	23·2	26·9		.....	.....	62·5	63·0	65·3	54·4	45·4	29·6	31·6	.....
1898	31·9	44·5	35·1	51·8	56·5	60·8	64·6	72·4	61·3	48·4	30·8	25·8	49·4
1899	26·6	31·3	.....	.....	.....	.....	.....	.....	.....		.....	.....	.....
1900	.....	.....	.....	48·9	54·8	61·7	65·7	60·6	55·8	45·6	28·1	32·5	.....
1901	20·1	22·6	38·6	43·9	55·3	58·8	66·2	70·4	53·1	.....	.....	.....	.....
1902	23·8	30·0	37·3	43·8	54·8	57·6	63·6	64·2	53·9	47·6	32·5	23·5	44·7
1903	24·4	21·2	27·4	43·7	54·1	65·8	63·0	63·8	51·1	45·4	32·5	29·1	43·5
1904	24·2	23·3	30·7	47·2	52·7	59·8	67·0	67·3	52·0	47·8	40·2	28·9	45·7
1905	26·2	22·8	43·2	48·2	53·4	61·2	60·7	67·8	56·4	40·3	33·7	27·8	45·9
1906	25·8	31·1	36·0	50·4	55·1	59·7	74·6	67·4	56·0	48·7	33·4	27·3	47·1
1907	5·3	24·8	31·3	43·6	56·0	60·0	67·7	61·0	56·0	48·3	38·1	30·3	43·5
1908	25·6	25·4	35·6	47·0	54·3	62·8	69·5	66·0	56·0	44·6	39·9	23·7	45·9
1909	9·1	26·8	38·8	44·0	53·5	61·7	64·8	63·6	59·6	46·3	34·2	21·3	43·6
1910	22·3	21·1	43·4	49·3	57·6	59·6	67·8	62·1	56·8	45·7	35·9	30·2	45·9
1911	13·3	18·5	36·8	44·5	51·5	60·4	67·4	64·7	55·4	45·8	26·6	23·7	42·4
1912	16·7	28·0	30·2	47·3	56·8	64·5	64·2	62·5	53·0	42·6	36·0	28·8	44·2
1913	15·3	15·4	28·7	46·4	53·5	60·5	64·5	65·4	55·2	42·8	35·4	28·7	42·6
1914	29·4	25·0	38·3	49·1	55·5	61·2	68·6	67·1	55·1	46·8	36·5	21·3	46·1
1915	20·1	31·7	41·5	50·7	54·5	59·2	65·1	70·5	54·7	47·0	31·5	27·0	46·1
Means	21·2	26·3	35·7	46·5	54·4	60·4	66·2	65·4	55·7	45·3	33·6	27·5	44·9
VICTORIA AND ESQUIMALT—Elevation, near sea level													
1881	35·0	40·0	45·0	48·0	50·0	56·0	57·0	56·0	53·0	46·5	41·3	40·5	47·3
1882	36·0	[illegible]	42·0	45·0	53·0	58·0	57·0	58·0	53·0	48·2	41·2	42·0	47·4
1883	36·3	34·3	44·6	46·3	51·7	55·7	58·3	57·9	56·0	48·0	44·3	41·0	47·8
1884	39·0	30·4	41·7	50·0	53·0	55·7	58·0	60·0	52·5	47·0	45·3	31·0	47·0
1885	37·4	44·2	46·1	47·4	53·6	57·1	60·9	58·2	56·2	50·3	46·2	42·8	50·1
1886	34·8	42·7	42·8	48·0	52·8	57·0	60·5	59·5	55·7	48·6	43·2	43·4	49·1
1887	41·0	29·5	44·2	46·2	51·9	55·2	57·7	57·1	54·1	47·0	42·6	41·6	47·4
1888	32·2	41·6	41·7	48·3	54·2	57·4	58·7	60·9	57·1	51·1	42·7	42·9	49·1
1889	38·8	41·0	48·2	50·5	55·9	58·7	61·2	58·6	53·8	53·8	45·0	37·3	50·3
1890	32·4	33·9	42·3	46·3	53·5	56·3	58·4	58·1	53·7	47·5	45·4	43·7	47·7
1891	42·2	33·7	41·1	47·8	52·6	55·3	59·9	58·6	54·1	50·6	45·8	40·2	48·5
1892	39·5	41·1	45·5	46·4	52·4	55·5	57·0	58·8	54·3	48·9	43·9	39·2	48·6
1893	36·0	34·5	42·7	44·4	50·9	54·3	57·6	57·6	53·2	47·0	40·0	[illegible]	46·7
1894	37·2	36·9	40·9	45·0	50·5	54·8	58·0	59·0	53·6	47·3	44·6	[illegible]	47·2
1895	37·3	42·9	42·5	46·4	51·7	55·9	58·8	57·5	51·8	47·7	[illegible]	40·1	48·0
1896	38·2	41·5	40·6	45·2	49·7	55·5	60·3	58·2	51·4	48·1	36·8	42·8	47·4
1897	38·5	40·1	37·8	48·0	53·1	56·4	57·8	60·1	53·2	48·0	40·9	41·0	47·9
1898	39·0	43·6	41·7	47·2	54·7	57·8	60·3	61·8	57·5	49·7	43·5	39·6	49·7
1899	39·2	37·7	42·1	47·0	50·0	55·3	61·8	58·2	57·0	49·5	50·2	43·0	49·3
1900	43·3	40·8	48·3	50·8	53·6	57·9	60·1	59·3	55·8	50·1	43·5	45·1	50·7
1901	39·0	41·1	44·4	46·0	52·6	54·7	57·4	61·0	56·1	54·4	48·5	43·0	49·8
1902	39·6	44·6	43·5	47·3	54·3	57·3	60·3	60·8	56·5	52·4	44·6	41·0	50·2
1903	41·9	39·8	41·3	46·5	51·6	59·0	58·2	59·6	55·6	51·2	44·5	43·0	49·4
1904	41·3	39·4	41·0	50·9	52·9	56·0	60·8	59·1	57·4	52·7	49·1	43·8	50·3
1905	41·0	41·7	47·9	50·3	52·6	56·7	61·2	59·4	56·3	47·7	44·8	42·6	50·2
1906	41·6	44·0	44·5	50·9	54·5	58·5	65·5	62·3	56·4	52·0	44·2	41·2	51·3
1907	33·3	41·7	42·4	48·4	56·0	59·2	62·9	60·4	58·4	51·5	47·4	42·6	50·3
1908	41·6	41·0	43·7	48·5	52·7	58·7	62·7	61·0	53·6	49·3	47·1	39·8	50·0
1909	32·5	41·4	43·7	45·3	52·2	58·0	59·6	59·3	57·1	50·4	44·2	36·7	48·5
1910	38·7	36·7	46·1	47·6	54·8	57·0	61·3	59·1	56·6	50·9	44·0	42·8	49·6
1911	36·2	39·0	43·7	45·5	52·3	56·3	62·3	60·2	55·5	50·1	42·8	41·4	48·8
1912	40·6	43·0	42·6	48·6	56·0	59·1	61·9	59·9	57·2	48·6	45·3	41·5	50·3
1913	36·1	38·4	41·4	49·0	53·9	59·8	61·8	62·6	56·6	48·8	44·1	42·8	49·6
1914	42·1	42·0	46·9	50·5	55·9	55·9	59·7	59·5	53·6	52·7	45·0	39·6	50·3
1915	40·5	43·3	49·6	51·2	53·9	57·8	59·9	62·0	56·5	51·1	43·3	41·4	50·9
Means	[illegible]8·3	39·5	43·6	47·7	53·0	56·8	59·8	59·5	55·1	49·7	44·3	41·2	49·0

MONTHLY AND ANNUAL MEAN TEMPERATURES AT SELECTED STATIONS IN THE STATES OF MONTANA, IDAHO AND WASHINGTON

No.	Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Annual
	MONTANA													
308	Anaconda	24·0	24·6	31·7	40·8	48·2	55·3	62·7	61·2	53·6	44·5	35·1	25·5	42·0
309	Butte	24·5	24·3	30·4	40·6	48·4	56·0	63·5	62·6	52·9	43·8	34·2	25·4	42·2
310	Columbia Falls	22·5	23·9	32 [illegible]	[illegible]	51·1	57·5	63·9	62·4	53·1	43·1	32·7	24·9	44·4
312	Dayton	23·8	26·6	33·6	43·8	51·1	58·9	64·9	63·4	54·9	44·4	35·0	27·3	43·7
318	Kalispell	13·6	23·8	33·0	42·5	51·0	58·0	64·3	62·9	55·9	42·5	32·0	23·9	41·7
302	Libby	24·7	28·4	35·9	46·4	53·6	59·2	64·4	65·0	54·8	45·5	34·8	27·2	45·0
319	Missoula	21·3	24·5	34·8	44·9	54·7	60·0	63·2	63·2	55·6	44·8	32·5	24·3	43·5
320	Ovando	16·2	18·2	28·4	39·2	47·7	54·4	60·1	58·2	50·3	40·6	29·5	19·[illegible]	36·1
321	Philipsburg	22·6	24·1	31·6	42·2	47·8	55·0	31·8	60·5	53·1	43·5	33·5	24·9	41·7
322	Plains	26·5	27·1	36·6	45·0	52·2	58·4	68·8	64·0	55·5	45·8	35·8	27·7	45·3

MONTHLY AND ANNUAL MEAN TEMPERATURES AT SELECTED STATIONS IN THE STATES OF MONTANA, IDAHO AND WASHINGTON—*Continued*

No. on map	Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
	IDAHO													
372	Coeur d'Alene	26·5	29·6	38·6	47·3	55·3	60·8	67·2	67·3	56·9	47·3	36·6	31·4	47·0
374	Kellogg	26·3	30·5	38·7	45·6	51·9	58·5	65·0	62·8	55·2	46·3	36·7	28·6	45·5
375	Lewiston	34·5	36·2	44·0	52·9	60·8	69·1	73·6	73·5	63·5	51·8	40·9	37·5	53·2
376	Moscow	28·9	31·5	37·9	46·1	52·8	58·7	66·5	65·7	57·1	48·6	37·8	31·2	46·9
307	Porthill	23·4	27·1	33·0	45·7	53·8	59·2	63·7	63·8	53·6	45·1	33·8	28·0	44·5
	EASTERN WASHINGTON													
336	Colville	21·6	27·5	36·8	47·0	55·1	62·2	67·7	65·3	56·4	45·2	33·8	26·7	45·4
337	Conconully	21·4	25·7	36·4	46·6	54·2	60·0	66·3	64·3	56·1	47·6	34·6	26·4	44·9
339	Lakeside	25·2	29·6	40·1	50·6	58·5	65·4	72·7	72·0	61·9	50·8	38·0	29·8	49·6
345	Spokane	26·7	30·1	38·9	47·7	56·1	63·4	68·8	67·9	58·8	47·3	37·3	30·8	47·8
346	Wilbur	22·4	27·3	37·7	46·3	53·2	59·0	64·8	63·6	56·2	46·9	35·6	27·4	45·0
	WESTERN WASHINGTON													
350	Blaine	35·2	37·7	40·7	46·3	52·3	57·4	60·7	59·7	54·3	48·1	41·3	37·9	47·6
354	Olga	38·5	40·4	43·3	47·8	52·8	56·6	59·4	50·1	55·5	49·9	44·4	41·7	49·1
355	Olympia	38·5	40·2	44·3	48·8	54·6	59·1	63·0	62·6	56·9	50·7	44·4	40·8	50·3
358	Port Crescent	36·0	37·2	40·5	44·7	49·1	53·4	56·3	56·2	52·5	47·4	42·3	38·3	46·2
360	Seattle	39·3	40·5	44·2	49·4	55·0	60·1	63·5	63·1	57·9	50·8	44·5	41·2	50·8
362	Snohomish	37·9	40·5	43·7	49·4	54·7	59·1	62·6	62·1	57·5	51·3	44·4	40·0	50·3
363	Tacoma	38·1	40·4	44·2	48·9	54·5	59·4	63·4	63·0	57·6	50·6	44·1	40·3	50·4
364	Tatoosh Is.	41·7	41·0	42·9	46·1	49·6	53·0	55·1	55·2	53·0	49·9	45·9	43·9	48·1

Note.—The numbers in the first column correspond to the numbers on the Precipitation map and to the numbers on the List of Precipitation Stations.

APPENDIX I

Hydraulic Conversion Tables and Convenient Equivalents

Definition of Terms

THE water flowing in a stream is frequently termed the 'run-off' or 'discharge.' Its volume is expressed in various units, each of which has become especially associated with a certain class of work. These units may be grouped into two main divisions : (1) Those which represent a rate of flow, as *miner's inch, gallons per minute, cubic feet per second* and *discharge in cubic feet per second per square mile*, and (2) those which represent the actual quantity of water, as *cubic feet, run-off depth in inches* and *acre-feet.*

The *miner's inch*, as its name implies, is a unit which was first employed in the Western States in connection with early measurements of water for mining purposes, and, fundamentally, is the rate of discharge per square inch of area of water discharging through a rectangular orifice under a head which is differently specified in various localities. The miner's inch, where still employed, is now usually defined by law and expressed in its equivalent of cubic feet per second. See brief statement respecting miner's inch at end of this appendix.

Gallons per minute and *millions of gallons* are units generally used in connection with domestic and municipal water supply, consumption being expressed in gallons per capita, while pumps, etc., are rated in terms of gallons per minute.

The units now most generally employed in connection with power and irrigation investigations are *second-feet, second-feet per square mile, run-off depth in inches* and *acre-feet.*

Second-foot—an abbreviation for cubic foot per second (c.f.s.)—is the rate of discharge of water flowing in a channel of one square foot in area at a velocity of 1 foot per second.

Second-feet per square mile is the number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

Run-off depth in inches is the depth to which a drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed over the area. It is used for comparing run-off with precipitation, which latter is usually expressed in depth in inches.

Acre-foot is the quantity required to cover an acre to the depth of 1 foot, and is equivalent to 43,560 cubic feet. It is a common unit of measurement of quantity, and is generally used in connection with storage.

CONVENIENT EQUIVALENTS *

LENGTH

1 inch = 0·083 foot = 2·54 centimetres.
1 foot = 12 inches = 0·3048 metre.
1 yard = 36 inches = 0·9144 metre.
1 statute mile = 63,360 inches = 5,280 feet = 1,760 yards = 80 chains = 1,609·35 metres = 1·60935 kilometres.

1 metre = 39·37 inches = 3·2808 feet = 1·094 yards.
1 kilometre = 3,281 feet = 1,094 yards = 0·6214 mile = five-eighths mile, nearly.

SURFACE

1 square inch = 0·006944 square foot = 6·4516 square centimetres.
1 square foot = 144 square inches = 929·03 square centimetres.
1 square yard = 9 square feet = 0·000207 acre = 0·8361 square metre.
1 acre = 43,560 square feet = 4,840 square yards = 4,046·87 square metres = 0·404687 hectare = 209 feet square, nearly.
1 square mile = 27,878,400 square feet = 3,097,600 square yards = 640 acres = about 2·59 square kilometres.

1 square metre = 1,550 square inches = 10·764 square feet = 1·1956 square yards.
1 hectare = 2·471 acres.
1 square kilometre = 100 hectares = 247 acres = 0·3861 square miles.

VOLUME

1 cubic inch = 16·3872 cubic centimetres.
1 cubic inch of water = 0·0036 imperial gallon = 0·0043 U. S. gallon, weighs 0·3613 lb.
1 cubic foot = 0·028317 cubic metre = 28·317 litres.
1 cubic foot of water = 6·24 imperial gallons = 7·48 U. S. gallons.
1 cubic foot of distilled water weighs 62·425 lbs. (at maximum density at 39·2°F.); 62·367 lbs. (at 60°F.). Surface or river water is slightly heavier, and, for ordinary computations, the weight of fresh water may be taken at 62·5 lbs., or 1,000 ozs., per cubic foot. Sea water weighs about 64·1 lbs. per cubic foot.
1 cubic yard = 0·76456 cubic metre.
1 acre-foot = 43,560 cubic feet = 271,472 imperial gallons = 325,850 U. S. gallons.

1 cubic metre, stere, or kilolitre = 35·3145 cubic feet = 1·30794 cubic yards = 220·36 imperial gallons = 264·17 U. S. gallons of water; weight, 2,204·7 lbs.
1 British imperial gallon = 277·274 cubic inches = 0·16046 cubic foot = 10 lbs. of water = 1·2003 U. S. gallons = 4·5435 litres.
1 United States gallon = 231 cubic inches = 0·1337 cubic foot = 8·355 lbs. of water = 0·8331 imperial gallon = 3·7854 litres.

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* In this table of equivalents, as a rule, only those units of the metric system which correspond to the British units here recorded are given. Others may readily be deduced by moving the decimal point. Thus a movement of the decimal point converts 0·404687 hectare here given as the equivalent of one acre, into 4046·87 square metres or 0·00404687 square kilometres. Also, in order to facilitate reference to the table of equivalents and to reduce its size, many of the less useful and more easily deduced equivalents are omitted; thus, the fact that 1 square inch equals 0·006944 square foot is given, but the corresponding equivalents of 0·0007716 square yard, 0·0000001594 acre and 0·0000000002491 square mile are omitted.

WEIGHT

1 pound avoirdupois (lb.) = 7,000 grains = 0·4536 kilogram.
1 ton (long) = 2,240 lbs. = 1·12 short tons = 1,016·0475 kilograms = 1·016 metric tons.
1 ton (short) = 2,000 lbs. = 0·89287 long ton = 907·2 kilograms = 0·9072 metric ton.

1 kilogram = 2·2046 lbs.
1 tonneau (metric ton) = 2,205 lbs. = 1·1023 short tons = 0·9842 long ton = 1,000 kilograms.
1 ton of water (2,240 lbs.) = 35·9 cubic feet = 224 imperial gallons.

PRESSURE

1 pound per square inch = 0·07031 kilograms per square centimetre = 2·307 feet of water = 2·035 inches of mercury.
1 metric ton (tonneau) per square metre = 204·8 lbs. per square foot.
1 foot head of water = 62·43 lbs. per square foot = 0·4335 lbs. per square inch.
1 atmosphere = 14·7 pounds per square inch = about 1 ton per square foot = about 1 kilogram per square centimetre.

VELOCITY

1 foot per second = 0·6818 mile per hour = 1·097 kilometres per hour.
1 mile per hour = 88 feet per minute = 1·467 feet per second = 1·609 kilometres per hour.

Miles per hour	Feet per second	Miles per hour	Feet per second	Feet per second	Miles per hour	Feet per second	Miles per hour
1	1·467	6	8·800	1	0·682	6	4·091
2	2·933	7	10·267	2	1·364	7	4·773
3	4·400	8	11·733	3	2·045	8	5·455
4	5·867	9	13·200	4	2·727	9	6·136
5	7·333	10	14·667	5	3·409	10	6·818

Acceleration due to gravity = 32·191374 feet per second, per second, at Greenwich.

Theoretical velocity (V) due to head (h), $V = \sqrt{2gh} = 8{\cdot}025\sqrt{h}$.

Note: A stone dropped from a height falls approximately 16 feet in one second, 64 feet in two seconds, 145 feet in three seconds, 250 feet in four seconds and 400 feet in five seconds from the time of its release. When the fall of a stone can be observed, this is sometimes useful in obtaining an approximate idea of the height of a direct fall or cliff.

Velocity of sound in dry air $= 1{,}090\sqrt{1 + 0{\cdot}00367t°C.}$ feet per second. (At temperature of 60°F. = about 1,120 feet per second)

POWER

1 horsepower = 550 foot-lbs. per second = 33,000 foot-lbs. per minute = 76·04 kilogram-metres per second = 745·65 watts = 0·74565 kilowatts = 42·416 British thermal units per minute = 2,545 B.t.u. per hour = 1·01387 horsepower (metric).
1 horsepower (metric) = 75 kilogram metres per second = 32,550 foot-lbs. per minute = 735·5 watts = 0·9863 horsepower.

1 kilowatt = 44,256·7 foot-lbs. per minute = 1·3597 horsepower (metric) = 1·3411 horsepower (about $1\frac{1}{3}$ horsepower) = 3,413 British thermal units per hour.
1 second-foot falling 8·81 feet = 1 horsepower.
1 second-foot falling 10 feet = 1·135 horsepower.
1 second-foot falling 11 feet = 1 horsepower, 80 per cent efficiency.

Note : To calculate approximate horsepower quickly :

$$\frac{\text{Second-feet} \times \text{fall in feet}}{11} = \left\{ \begin{array}{l} \text{net horsepower on waterwheels} \\ \text{realizing 80 per cent of theoretical power.} \end{array} \right.$$

1 British thermal unit = 778 foot-lbs. This is frequently termed Joule's equivalent.

FLOW AND STORAGE OF WATER

1 second-foot = 1 cubic foot per second = 0·02832 cubic metre per second = 1·699 cubic metres per minute = 35·7143 British Columbia miner's inches = 6·2321 imperial gallons per second = 538,472 imperial gallons per day = 7·48 U. S. gallons per second = 646,317 U. S. gallons per day = 0·9917 acre-inch per hour (about 1 acre-inch per hour).
1 cubic metre per second = 35·31 second-feet.
1 cubic metre per minute = 0·5886 second-feet.
1 miner's inch in British Columbia = 0·028 second-feet = 1·68 cubic feet per minute = 0·1745 imperial gallon per second.
100 British Columbia miner's inches = 2·8 second-feet = 17·45 imperial gallons per second.

100 British imperial gallons per minute = 0·268 second-foot.
100 United States gallons per minute = 0·223 second-foot.
1,000,000 British imperial gallons per day (24 hours) = 1·86 second-feet.
1,000,000 United States gallons per day (24 hours) = 1·55 second-feet.

1 acre-foot = a depth of 1 foot over 1 acre = 43,560 cubic feet = 1,613 cubic yards = 1,233 cubic metres = 271,472 imperial gallons = 325,850 U. S. gallons = 0·50416 second-foot for 1 day.
2 acre-feet stored water will maintain a flow of about 1 second-foot for 1 day.
1,000,000 British imperial gallons = 3·68 acre-feet.
1,000,000 United States gallons = 3·07 acre-feet.
1,000,000 cubic feet = 22·95 acre-feet.

1 second-foot for 1 day = 86,400 cubic feet = 1·9835 acre-feet and covers 1 square mile 0·03719 inch deep.
1 second-foot for one 28-day month = 55·54 acre-feet and covers 1 square mile 1·041 inches deep.
1 second-foot for one 29-day month = 57·52 acre-feet and covers 1 square mile 1·079 inches deep.
1 second-foot for one 30-day month = 59·50 acre-feet and covers 1 square mile 1·116 inches deep.
1 second-foot for one 31-day month = 61·49 acre-feet and covers 1 square mile 1·153 inches deep.
1 second-foot for 1 year (365 days) = 31,536,000 cubic feet = 724 acre-feet and covers 1 square mile 1·1312 feet or 13·572 inches deep.
1 inch deep on 1 square mile = 2,323,200 cubic feet = 0·0737 second-foot for one year.
1 foot deep on 1 square mile = 27,878,400 cubic feet = 0·88 second-foot for one year.

1,000,000,000 (1 U.S. billion) cubic feet = 11,570 second-feet for 1 day.
1,000,000,000 cubic feet = 413 second-feet for one 28-day month.

1,000,000,000 cubic feet = 399 second-feet for one 29-day month.
1,000,000,000 cubic feet = 386 second-feet for one 30-day month.
1,000,000,000 cubic feet = 373 second-feet for one 31-day month.
100 British imperial gallons per minute for 1 day = 0·530 acre-foot.
100 United States gallons per minute for 1 day = 0·442 acre-foot.
100 British Columbia miner's inches for 1 day = 5·554 acre-feet.

MAP SCALES

Miles to 1 inch		Inches to 1 mile		Scale
100	=	0·01000	=	1 : 6,336,000
50	=	0·02000	=	1 : 3,168,000
35	=	0·02857	=	1 : 2,217,600
30	=	0·03333	=	1 : 1,900,800
20	=	0·05000	=	1 : 1,267,200
12	=	0·08333	=	1 : 760,320
10	=	0·10000	=	1 : 633,600
8	=	0·12500	=	1 : 506,880
5	=	0·20000	=	1 : 316,800
4	=	0·25000	=	1 : 253,440
3	=	0·33333	=	1 : 190,080
2	=	0·50000	=	1 : 126,720
1	=	1·00000	=	1 : 63,360
½	=	2·00000	=	1 : 31,680
⅙	=	6·00000	=	1 : 10,560

Scale		Inches to 1 mile		Miles to 1 inch
1 : 1,125,000	=	0·05632	=	17·75565
1 : 1,000,000	=	0·06336	=	15·78282
1 : 500,000	=	0·12672	=	7·89141
1 : 250,000	=	0·25344	=	3·94570
1 : 125,000	=	0·50688	=	1·97285
1 : 90,000	=	0·70400	=	1·42046
1 : 62,500	=	1·01376	=	0·98642
1 : 45,000	=	1·40800	=	0·71023
1 : 30,000	=	2·11200	=	0·47349
1 : 24,000	=	2·64000	=	0·37878

Planimeter Measurements of Areas

The following table of areas of quadrilaterals for latitudes of British Columbia will be of assistance in measuring drainage areas from maps by means of planimeter.*

Middle latitude of quadrilateral	Area in square miles	Middle latitude of quadrilateral	Area in square miles	Middle latitude of quadrilateral	Area in square miles	Middle latitude of quadrilateral	Area in square miles
Areas of Quadrilaterals of Earth's Surface of 1° extent in Latitude and Longitude							
° ′		° ′		° ′		° ′	
48 30	3,173	51 30	2,985	54 30	2,785	57 30	2,578
49 30	3,111	52 30	2,918	55 30	2,717	58 30	2,508
50 30	3,047	53 30	2,852	56 30	2,648	59 30	2,436

* For more extensive tables consult, 'Geographic Tables and Formulas,' compiled by Samuel S. Gannett, in *U.S. Geological Survey Bulletin No. 214.*

Note—Considerable time may be saved by calibrating the planimeter directly from the map upon which the area is to be measured. By doing this, errors due to shrinkage or stretch of paper, and any instrumental 'constant' are eliminated. The calibration is made by noting the revolutions of the planimeter wheel, when measuring an area of known extent, such as a quadrilateral of the earth's surface. From this procedure may be ascertained the amount of revolution of the planimeter wheel corresponding, respectively, to unit areas at given latitudes. When a large number of areas are to be measured from the same map it may be more convenient to set the planimeter to record areas directly in square miles or in acres, as the case may be, or in some simple multiple or fraction of these units. The operator, dependent upon the accuracy demanded and upon the scale and extent of the map, may require to re-set the instrument for various portions of the map. If a record is kept of such settings of the planimeter it will expedite the adjustment of the instrument for measuring drainage areas at subsequent dates, or on other maps of the same scale. The setting of the planimeter should always be checked by measuring a quadrilateral.

Areas of Quadrilaterals of Earth's Surface of 30′ extent in Latitude and Longitude

°	′		°	′		°	′		°	′	
48	15	797·1	51	15	749·8	54	15	700·4	57	15	648·9
48	45	789·4	51	45	741·7	54	45	691·9	57	45	640·2
49	15	781·6	52	15	733·6	55	15	683·4	58	15	631·4
49	45	773·7	52	45	725·4	55	45	674·9	58	45	622·5
50	15	765·8	53	15	717·1	56	15	666·3	59	15	613·6
50	45	757·9	53	45	708·8	56	45	657·6	59	45	604·6

Areas of Quadrilaterals of Earth's Surface of 15′ extent in Latitude and Longitude

° ′ ″		° ′ ″		° ′ ″		° ′ ″	
48 07 30	199·76	51 07 30	187·96	54 07 30	175·62	57 07 30	162·78
48 22 30	198·80	51 22 30	186·95	54 22 30	174·57	57 22 30	161·68
48 37 30	197·83	51 37 30	185·94	54 37 30	173·51	57 37 30	160·59
48 52 30	196·86	51 52 30	184·92	54 52 30	172·46	57 52 30	159·49
49 07 30	195·89	52 07 30	183·90	55 07 30	171·39	58 07 30	158·39
49 22 30	194·91	52 22 30	182·88	55 22 30	170·33	58 22 30	157·29
49 37 30	193·93	52 37 30	181·85	55 37 30	169·26	58 37 30	156·16
49 52 30	192·94	52 52 30	180·82	55 52 30	168·19	58 52 30	155·07
50 07 30	191·95	53 07 30	179·79	56 07 30	167·11	59 07 30	153·96
50 22 30	190·96	53 22 30	178·75	56 22 30	166·03	59 22 30	152·84
50 37 30	189·96	53 37 30	177·71	56 37 30	164·95	59 37 30	151·72
50 52 30	188·96	53 52 30	176·67	56 52 30	163·87	59 52 30	150·60

Areas of Quadrilaterals of Earth's Surface of 10′ extent in Latitude and Longitude

°	′		°	′		°	′		°	′	
48	05	88·85	51	05	83·61	54	05	78·13	57	05	72·
48	15	88·57	51	15	83·31	54	15	77·82	57	15	72·10
48	25	88·28	51	25	83·01	54	25	77·51	57	25	71·78
48	35	88·00	51	35	82·71	54	35	77·19	57	35	71·46
48	45	87·71	51	45	82·41	54	45	76·88	57	45	71·13
48	55	87·42	51	55	82·11	54	55	76·57	57	55	70·80
49	05	87·13	52	05	81·81	55	05	76·25	58	05	70·48
49	15	86·84	52	15	81·51	55	15	75·94	58	15	70·15
49	25	86·55	52	25	81·20	55	25	75·62	58	25	69·82
49	35	86·26	52	35	80·90	55	35	75·30	58	35	69·49
49	45	85·97	52	45	80·60	55	45	74·99	58	45	69·17
49	55	85·68	52	55	80·29	55	55	74·67	58	55	68·84
50	05	85·39	53	05	79·98	56	05	74·35	59	05	68·51
50	15	85·09	53	15	79·68	56	15	74·03	59	15	68·18
50	25	84·80	53	25	79·37	56	25	73·71	59	25	67·84
50	35	84·50	53	35	79·06	56	35	73·39	59	35	67·51
50	45	84·21	53	45	78·75	56	45	73·07	59	45	67·18
50	55	83·91	53	55	78·44	56	55	72·75	59	55	66·85

Miner's Inch

The 'miner's inch' of water, as a unit for the measurement of quantity, has been used from the earliest days of hydraulic mining in the state of California. This unit, while still extensively employed, is, nevertheless, rapidly being superseded by the more modern units of the 'second-foot' and the 'acre-foot.' Owing, however, to the fact that the miner's inch has been employed in specifying the quantity of water in many of the early water patents or water records in British Columbia and in adjoining portions of the United States, it is desirable, here, to refer to the miner's inch somewhat at length. This is

more especially desirable because relatively little information has been assembled upon this subject.*

As just intimated, the quantity of water corresponding to the miner's inch varies substantially for different districts, owing to the fact that both sizes of apertures and heads of discharge at measuring orifices vary. The aperture through which the water was measured for a miner's inch was generally rectangular in shape, from 1 to 12 inches high, and sometimes several feet in length. There was no uniformity in the thickness of the wall—usually of lumber—through which the aperture was made. Sometimes, its edges were square; sometimes, they were chamfered; and, sometimes, one or more edges would be chamfered while the other edges would be square. The head, or depth of water over the orifice, varied in different localities from 4½ to 12 inches above the centre of the aperture. By way of illustration, in Sierra county, California, the miners operating along the Yuba river adopted a module 4 inches high with a head of 9 inches above the centre of the orifice. The bottom of the aperture was at the bottom of the box. Such an aperture 4 inches high, 50 inches wide, and with a head of 9 inches above the centre of orifice was considered as delivering 1,000 inches. This measurement came to be known as the Smartsville inch, and has been estimated to be 0·0299 cubic foot per second. In Stanislaus, Calaveras and Nevada counties, the module was 2 inches high in a 3-inch plank, with the outer edge chamfered, the head being 7 inches above the centre of the opening.

Again, in Colorado the miner's inch, as early used, was the equivalent of about one-fiftieth of a cubic foot of water per second. Mr. John Field, State Engineer of Colorado, who is familiar with early western mining practice, expresses the view that the 'inch' originally was independent either of *orifice* or of the *head* upon it, but related to the cross-section of the open flumes, ditches, and sluice boxes through which the water was conveyed. Thus, in a letter, Mr. Field states:

> 'The inch referred to was the cross-section of the conduit and practically disregarded velocity. As you are probably aware, the average velocity of 3 feet per second is about as much as excavations in earth will stand. Assuming that this average maximum velocity was given to the ditches, we find that the cross-section expressed in inches gives results in an inch of cross-section discharging 1–48th of a cubic foot per second. For the purpose of mental calculation it is readily seen that this would be assumed by the miners to be 1–50th of a cubic foot per second. I think this the much more reasonable explanation of why 1–50th of a cubic foot per second is taken as equal to an inch than on the theory that a certain "head" was assumed.'

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* This statement is based upon communications to Arthur V. White, Toronto, rec… through the courtesy of the State Engineers of California, Oregon, Montana, Idaho, Washington, etc., and from the United States Geological Survey. Consult *Report of the Director of the Mint upon the Statistics of the Production of the Precious Metals in the United States*, Washington, 1882, pages 645-6, being *Executive House Document* No. 216, 47th Cong., 1st Sess., containing art… credited to the *New York Mining Record*. For references to miner's inch consult, also, *Transactions of the American Society of Civil Engineers*, Vol. VII, page 373 ; Vol. XV, page 349 ; Vol. XVI, page 135. An early use of the term 'inch' as a unit of water measurement appea… Lardner, *Handbook of Natural Philosophy—Hydrostatics*—1858, page 238 ; compare definiti… 'Inch' in Murray's *New English Dictionary on Philological Principles*.

Subsequently, when irrigation ditches were constructed in Colorado on the more level lands, they were usually larger and deeper, and, as a consequence, the service boxes inserted in the banks of the ditch were at a greater depth below the surface, thus discharging a greater quantity of water per inch of discharge area. This subject, subsequent to 1883, was investigated by the second State Engineer, with the result that 38·4 inches was declared equal to 1 cubic foot per second. The Legislature attempted to make this unit the legal standard.*

The second-foot is now the commonly accepted general standard in Colorado, and the units of conversion are, for the 'miner's inch', 50; and, for the 'statutory inch', 38·4 inches per second-foot, respectively.

In the delivery of water by the inch, there is a wide diversity of custom. In some districts, the price charged is by the inch, running continuously for 24 hours; in others, 16-hour, 12-hour, or even 10-hour run obtains, each period being usually designated as a day.

The miner's inch and its respective equivalent in certain states may very briefly be referred to as follows :

California—The State Legislature of California, by an Act, chap. **CCXXII**, approved March 23, **1901**, intituled *An Act fixing and defining a miner's inch of water*, enacted as follows :

> 'Section 1. The standard miner's inch of water shall be equivalent or equal to one and one-half cubic feet of water per minute measured through any aperture or orifice.'

Bearing in mind the fact that one and one-half cubic feet per minute is 0·025 cubic feet per second, Mr. P. W. Norley, Assistant State Engineer, states: 'This statute creates an anomalous condition in that, under the Civil Code, sec. 1,415,† an appropriator must describe his appropriation as so many inches under a 4-inch pressure and mounting to 0·20 second-feet to the inch, and, if he sells the water by the inch, must deliver 0·025 second-feet to the inch. In most irrigated sections, where water is sold by the inch, the old standard is adherred to.'

Oregon—In Oregon, there is no statute defining a miner's inch or specifying how the same shall be measured, but it has generally been accepted, and so held in Oregon Court decisions, that a miner's inch shall be equal to one-fortieth of a cubic foot per second. Acts were passed in 1891 and in 1899, one referring to diversion of water for general use and for irrigation, and the other for power (see sections 6,528 and 6,555 of Lord's *Oregon Laws*) which made some attempt to define the measurement of water by the miner's inch. These laws, however, neither definitely specified quantity of water nor rate of flow. Considerable confusion arose and both Acts were repealed in 1913 by chap. 86, *Session Laws of 1913*.

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* See *Colorado Statutes Annotated*, by R. S. Morrison and Emilio D. DeSoto, 1912, section 7026 ; or *Mills' Annotated Statutes*, section 4643 ; see also Act of 1874, p. 309, sec. 3, amending Act of 1864, p. 149, sec. 3 ; also *R.S.* 1868, p. 638 ; *G.L.* 1877, pp. 926, 927, sec. 2,779 ; *G.S.* 1883, p. 1,015, sec. 3,472.

† Consult the *Civil Code of the State of California*, adopted March 21, 1872, with amendments up to and including those of the forty-first session of the Legislature, 1915, edited by James H. Deering, section 1,415.

Montana—In 1899, the second-foot was made the legal unit of measurement by *An Act establishing a Standard of Measurement of Water*, approved March 3, 1899. Section 1 of this Act provided that : 'Hereafter a cubic foot of water (7·48 gallons) per second of time shall be the legal standard for the measurement of water in this state.' Section 2 provided : 'Where water rights expressed in miner's inches have been granted, one hundred miner's inches shall be considered equivalent to a flow of two and one-half cubic feet (18·7 gallons) per second ; two hundred miner's inches shall be considered equivalent to a flow of five cubic feet (37·4 gallons per second) and this proportion shall be observed in determining the equivalent flow represented by any number of miner's inches.' *

Idaho—In this state, also, the second-foot is the legal unit of measurement. But the miner's inch has not a legal status, although 50 miner's inches, as measured under a 4-inch pressure, have been regarded as practically the equivalent of a second-foot. The second-foot was made the legal unit by an Act approved Feb. 25, 1899. Section 1 states :† 'A cubic foot of water per second of time shall be the legal standard for the measurement of water in this state.' Chapter 37 of the Idaho Sessional Laws of 1913 provides that: 'Whenever it is desired to appropriate and store flood or winter-flow waters, the applicant shall specify in acre feet the quantity of such flood or winter-flow waters which he intends to store.' In other words, for normal-flow waters, by direct appropriation, the unit is the second-foot, and, for storage waters, the unit is the acre-foot.

Washington—In this state the miner's inch has no legal standing, although the civil engineers of the state recognize the miner's inch as the equivalent of one-fortieth of a cubic foot per second. The legal unit of measurement for flowing water is the cubic foot per second. This was established by statute approved March 26, 1890.‡

British Columbia—The various steps in the evolution of the method of measuring the miner's inch in this province have been given in Chapter III dealing with 'Water Legislation in British Columbia.' See the references to the Rules and Regulations of 1860 ; to the Gold Mining Ordinance of 1865 ; to the Land Amendment Act of 1882 (chap. 6), and to the Land Amendment Act of 1886 (chap. 10). Under the Water Clauses Consolidation Act of 1897, applicants for water privileges were required to state in their applications 'the number of inches of water applied for.' In Sec. 143 of this Act, rules are given for the measuring of the miner's inch and are similar to those given in the Land Amendment Act of 1886. It is also stated that 'In cubic measurement, one inch of water shall mean a flow of water equal to 1·68 cubic feet per minute.' By the Water Act, 1909, the second-foot was made the unit of measurement of flowing water and the acre-foot the

* See Day's *Revised Codes of Montana*, 1907, secs. 4,854 and 4,855. For concise description of measuring device, consult *Civil Code of Montana*, sec. 1,893 of Title VIII, Part IV, Division II.

† Consult *Statutes of 1899*, also the *Revised Codes of Idaho*, 1908, sec. 3,241.

‡ See Remington and Ballinger's *Annotated Codes and Statutes of Washington*, sec. 6,315 26 Wash., 450, also 26 Wash., 439.

unit of measurement of quantity, and applicants had to specify the quantity of water applied for. By the Amending Act of 1912, applicants could state this quantity in miner's inches, or gallons per day, as well as in second-feet or acre-feet.

Under the Water Act, 1914, applicants for a water record may describe the quantity required in second-feet, acre-feet, gallons per day or miner's inches, and, in the interpretation section, the miner's inch is defined as 0·028 cubic foot per second. This corresponds to the 1·68 cubic feet per minute mentioned above.

APPENDIX II

Bench Marks

List of bench-marks, for reference for tide levels, established by the Tid and Current Surveys of Canada, or by the Admiralty Surveyors, on Vancouv Island and the Mainland Pacific Coast, British Columbia.* Consult 'Tid on Pacific Coast,' chapter IX.

On Vancouver Island—East Coast

Sidney—B.M.; near the foot of Beacon street. The top of a brass bolt drille vertically into the granite rock on the north side of the Governmen wharf, at 143 feet from the outer abutment of the wharf, and 11½ fee from the side of the wharf. It is about 3½ feet below extreme high wate

Tod Inlet—B.M.; the top of an iron bolt set vertically at 2 ft. 3 in. east fror the side of the door of the steam turbine house of the Vancouver Port land Cement Co.

Cowichan—B.M.; the Admiralty bench-mark here is a broad arrow cut on large rock, about 75 feet west of the shore end of the wharf at Cowichan

Nanaimo—The Admiralty chart survey was made by Commander M. H Smyth, R.N., in 1899. The note regarding datum on chart of Nanaim harbour, No. 578, is as follows : 'The datum to which the sounding are reduced is 18·6 feet below the summit of the masonry beacon on Beacon rock, which corresponds to ten feet below a mark (10) cut in the per pendicular rock surface close to the small landing stage on the north sid of the peninsula fronting the town, and adjoining the ballast wharf. This mark was used for reference in the dredging operations in the harbour, carried out by the government.

The beacon referred to, is a truncated cone of concrete and iron, and its surface is rough and somewhat rounded. The mark on the rock should give a more definite elevation ; but, after careful search in 1905, it could not be found, owing to the vagueness of the description. The mark is within the range of the tide, and the rocks are grown over with barnacles, which were cleaned off in several places in the endeavour to find the mark.

Comox—Chart name, Port Augusta. The chart survey was made by Commander M. H. Smyth, R.N., in 1898, and the bench-mark at Comox serves to define the datum for the whole extent of Baynes sound.

* Most of these bench-marks are from a manuscript list supplied by the courtesy of Dr. W. Bell Dawson, Superintendent of Tidal and Current Surveys. For fuller reference to bench-marks at Nanaimo, Comox, Hardy Bay, Banfield and Port Simpson, see pages 14-17 of *Tide Levels and Datum Planes on the Pacific Coast of Canada*, by W. Bell Dawson, *Sessional Paper* No. 21c, 5-6 Ed. VII., Department of Marine and Fisheries, Ottawa, 1906.

The note on the general chart of Baynes sound is as follows :—"The soundings are reduced to 23·9 feet below the level of the slab at Goose Spit Magnetic Observation spot.' This spot is marked by a triangle on the charts of Baynes sound and Comox, Nos. 333 and 3,127.

The Magnetic Observation spot is on the northwest shore of Goose spit, in the second small bay west of the Admiralty building and wharf. It is between the last two rifle butts towards the southwest end of the spit, and ten feet back from the edge of a low bank running along the beach. It consists of a cement slab, about 1[illegible] inches square, set level with the surface of the sandy ground. It is marked: *Mag. Obsy., Egeria, 1898*, in letters of lead let into the slab. Its level is about ten feet above high water mark.

There is another Observation spot, for latitude and longitude, which is farther to the south-west and farther back from the shore. It is a similar slab of cement ; but it is a few inches above the ground, is differently marked, and cannot be mistaken for this one.

Salmon River ; Johnstone Strait—B.M.; a bolt drilled horizontally into the rock on the shore facing the wharf ; at 42 feet south from the third face-pile from the inside corner of the wharf.

Hardy Bay, V.I.—B.M.; copper bolt, 1¼ inches diameter, drilled into the rock on the north side of the Government wharf. It is 58 feet from the first pile bent of the wharf at the shore end, and 8 feet from the side of the wharf. It is about two feet below extreme high water.

On Vancouver Island—West Coast

Banfield, Barclay Sound—B.M.; brass bolt drilled into the rock at 20 feet from the southeast corner of the wharf ; about the level of high water.

Port Alberni—B.M.; brass bolt set at an angle in the slaty rock on the shore, at 48 feet from the eastern corner of the wharf, and 83 feet from the front of Mr. Waterhouse's store. It is about 4 feet below extreme high water.

B.M.; on the concrete foundation of the boiler in Mr. Bird's saw-mill, near the most westerly corner; the surface of the concrete at a point marked by a vertical groove in the brickwork above.

Tofino, Clayoquot Sound—B.M.; brass bolt drilled into the rock at 23½ feet eastward from the remains of the old wharf. It is about the level of high water.

B.M.; on the door-sill in the foundation of life-boat station, at the west side and close to the door-jam.

On Mainland Coast

Squamish, Head of Howe Sound—B.M.; broad arrow made of sheet metal on the top of the cap of the P.G.E. Railway wharf; directly over the eighth pile from the outer corner of the wharf on the west side.

Lund—B.M.; brass bolt set vertically into granite rock at 12 feet from th west side of Thulin Bros.' rear storehouse at the end of their wharf. I is about the level of extreme high water.

Bute Inlet (at the head)—B.M.; brass bolt set vertically into granite roc about 500 feet southwest along the shore from the only stream runnin down the cliff near the mouth of the Homathko river. It is about 2 fee below high water at spring tides.

Wadham, Rivers Inlet—B.M.; on the south side of the bay in which Wadham' cannery is situated ; at 55 feet from the point at which the rock begins which rises to the southward into cliffs. A brass bolt drilled at an angl into the rock at about the level of extreme high water.

Namu—B.M.; the top of an iron ring bolt drilled into the rock at the foot o the steps leading down from the wharf; at 38 feet back from the head o the wharf and 14 feet from its west side.

Bellakula—B.M.; in the rock near the outer end of the long wharf; a bras bolt set horizontally into the rock at 5 feet above extreme high water and marked with the letters "B.M." chiselled into the face of the rock.

Kitimat—B.M.; at the northerly end of a small ridge of rock on the north side of the wharf. The top of a brass bolt drilled into the rock at 86 feet from the inner end of the wharf where it meets the village sidewalk. This bolt is below the level of high water.

Claxton—B.M.; the top of an iron rod set vertically into the rock at 167 feet west of the stage leading to the wharf and 29 feet from the face of the crib-work along the shore.

Port Essington, Skeena River—B.M.; near the east side of the most easterly of the wharves of the Anglo-British Columbia Canning Co. The eye of a ring bolt in the solid rock at 85 feet back from the front of the wharf and 14 feet from its east side.

Prince Rupert—B.M.; brass bolt in the concrete pier at the foot of McBride street. The bolt is set vertically into the concrete at 16 feet from the shore side and 15 inches from the west side. The top of the bolt is flush with the surface of the concrete.

Port Simpson—The bench-mark to which the tide levels are referred, is a brass bolt with a round head, drilled into the rock, in the rocky foreshore which extends northward from the Hotel Northern. This rocky part of the foreshore is dry at half tide. The bolt is west of the wharf and is 174 feet from the angle between the side of the wharf and the hotel platform.

The elevation of 100·00 feet was assumed for the reference point first used, which was cut on the rock in another position. In the summer of 1905 the final bench-mark was put in, and the levels completed.

Stewart, Portland Canal—B.M.; in the face of the cliff at 50 feet due south of the southern end of the wharf; a brass bolt set horizontally in the rock at 3½ feet above the plank walk and about 10 feet above extreme high tide.

DATUM PLANES

For description of datum-planes at Victoria, Esquimalt and Vancouver, also for list of bench-marks and other reference points defining the average low-water datum used in the preparation of the Admiralty charts, consult *Tide Levels and Datum Planes on the Pacific Coast of Canada.** Respecting the datum used in preparing the charts, this publication states :

'The datum in all cases, is low water at ordinary spring tides ; which is usually determined independently in each locality or at most for the extent of some one chart. It cannot therefore be assumed that the datum is at the same actual elevation throughout a region of any great extent.

'The reference points for the level of the datum are either bench-marks or tide rocks. The bench-mark usually consists of a broad arrow cut in the rock ; and the reference measurement, which fixes the datum, is taken from the cross line at its point.'

Referring to the datum-planes in use in the vicinity of Fraser River delta, the *Annual Report of the Water Rights Branch*, Victoria, for 1917, states :

'The establishing of definite figures correlating the various datums in use on the lower mainland has made further progress, and we are indebted to A. J. Dalzell, of the City Engineer's Office, Vancouver, for the final figures relating to this important subject. The table given herewith has been submitted to Dr. Dawson, at Ottawa, for confirmation and may now be taken as correct.'

BRITISH COLUMBIA MAINLAND DATUM PLANES

Datum planes referred to Vancouver Harbour tide levels	Ordinary low water	Mean sea-level	High water level
	Feet	*Feet*	*Feet*
Admiralty datum (O.L.W.)	0·00	− 8·03	−13·00
Mean sea level (M.S.L.)	+ 8·03	0·00	− 4·97
High-water level (average of higher high water)	+13·00	+ 4·97	0·00
Datum of Canadian Pacific Railway Co.	−84·77	−92·80	−97·77
Datum, City of Vancouver	−83·52	−91·55	−96·52
Datum, City of New Westminster	+16·75	+ 8·72	+ 3·75
Datum, Provincial Water Dept., Fraser River	− 0·70	− 8·73	−13·70

* See foregoing footnote ; consult also the latest Admiralty charts and *Altitudes in Canada*, by James White, especially Introduction thereto, Commission of Conservation, Ottawa, 1915.

BIBLIOGRAPHY

THE author of this report, in his research relating to the water-powers of British Columbia, has recognized the fact that development of these water-powers will prove of real service only in so far as it contributes to the advancement of the Province as a whole.

To attain this end there must be co-ordinated beneficial utilization of the inland waters, and hence a study of the history of the development of the Province becomes indispensable. Such study should extend to the development of the agricultural areas, of the mining industry, of the timber industry, of the fisheries, as well as of other natural resources, because each of these is and has been, in greater or less degree, linked up with and dependent upon the utilization of inland waters.

There are, it is true, already available certain lists of books, government reports, etc., relating to the Province,—too often of a heterogeneous character—but, to the reader seeking information, it has been an almost hopeless task to select readily from such lists, books containing information most germane to a particular subject. It was early decided, therefore, to prepare for this report a more classified and descriptive bibliography and to include in it only such publications as would constitute a safe and ready guide to the literature relating, both directly and indirectly, to the history of British Columbia, including, of course, the development of its natural resources.

Some reports, as for example those of the Geological Survey of Canada, of the Royal Geographical Society of Great Britain, and of the Royal Society of Canada, are voluminous, and yet these publications contain much of the basic historical and exploratory information respecting the pioneer work in British Columbia. To make an independent research in such volumes for information relating to the characteristics of various watersheds of British Columbia, etc., would, in many instances, be impracticable. For these reports, therefore, comprehensive lists—which will be found of much value—have been included.

The bibliography here presented is not offered as a complete one, but rather as one containing the most representative publications.

On account of the great natural attractions of British Columbia for sportsmanship and travel, a few works relating specifically to these pastimes

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Author's Note—It had been my intention to include in this bibliography a number of additional and subsidiary subject classifications, but consideration of space precludes this being done. Attention, however, is here drawn to the fact that many of the notes accompanying the text of this report contain references which constitute a ready guide to publications dealing specifically with certain subjects cognate to water-power development. For example, respecting damage caused by floods, see note on page 7 ; for various works relating to subsoil water, the law relating thereto, etc., see notes on pages 8, 9, 10 and 11 ; respecting proposed power developments in the United States on the Columbia and Pend-d'Oreille rivers, see note on page 29 ; for various aspects of problems respecting the exportation and use of electrical energy, see note on page 149; for publications relating to British Columbia tides, see notes on pages 178, 179 and 180 ; etc.,—*A. V. W.*

have been included. Many a sportsman pioneering the inland water-highways has been the precursor of future agricultural or industrial activity.

While, for convenience of reference, the publications have been grouped under several broad subject headings, yet it will be understood that the contents of the various publications are by no means restricted to these subjects. This classification will assist those making research to obtain quickly a knowledge of authoritative works respecting the subjects listed, which are :

I. General Reference Works.

II. Guides, Handbooks and Other Publications giving descriptive information and historical data relating to various natural resources of the Province.

III. Topography—Government and other publications containing descriptions of the physical characteristics of various watersheds.

IV. Travel and Exploration—Mountaineering and other Sport.

V. Histories and Works of Historical Interest, including North West Coast Voyages, Hudson's Bay Company Affairs, International Waters, Boundaries, Treaties.

I—GENERAL REFERENCE

ATLAS OF CANADA. Second Edition. Issued by the Department of the Interior. Folio. 14 pp. of text, and 124 pp. of maps and diagrams. Ottawa, 1915.

ALTITUDES IN THE DOMINION OF CANADA, by James White. 2nd ed. 8vo, 603 pp., maps and profiles. Commission of Conservation, Ottawa, 1915.

DICTIONARY OF ALTITUDES IN THE DOMINION OF CANADA, by James White. 2nd ed. 8vo, 251 pp. Commission of Conservation, Ottawa, 1916.

HANDBOOK OF CANADA. British Association for the Advancement of Science, Toronto Meeting, 1897. 8vo, 415 pp., maps. Toronto, 1897.

GEOGRAPHIC BOARD OF CANADA,—*Decisions*, Reports of. In progress. The Fifteenth Report contains all decisions to March 31, 1917. 8vo, 353 pp. Ottawa, 1917.

GAZETTEER OF BRITISH COLUMBIA, A : Containing the Names, Locations and General Information Regarding the Cities, Towns, Post Offices, Settlements, Islands, Rivers, Capes, Bays and Mountains of the Province. 8vo. 114 pp. Vancouver, 1909.

BRITISH COLUMBIA COAST NAMES, 1592-1906, to which are added a few names in adjacent United States territory, Their Origin and History ; by Captain John T. Walbran. (Canadian Fisheries Protection Service and Commanding C.G.S. "Quadra" 1891-1908). 8vo, 546 pp., map and illus. Ottawa, 1909.

BRITISH COLUMBIA PILOT, THE : Third Edition, including the Coast of British Columbia from Juan de Fuca Strait to Portland Canal, together with Vancouver and Queen Charlotte Islands, compiled from Admiralty Surveys. Published by order of the Lords Commissioners of the Admiralty. 8vo, 596 pp., with index map to published Admiralty charts, London—Printed for the Hydrographic Office, Admiralty. London, 1905.

COAST OF BRITISH COLUMBIA, THE ; including the Juan de Fuca Strait, Puget Sound, Vancouver and Queen Charlotte Islands. Publication No. 96. Hydrographic Office, U.S. Navy—compiled by R. C. Ray. 8vo, 484 pp., index map to charts. Washington, 1891.

TIDE TABLES FOR THE PACIFIC COAST OF CANADA. Issued annually by the Tidal and Current Survey, Department of the Naval Service, Ottawa, by W. Bell Dawson, Supt.
Note—See reference to 'Range of Tidal Levels' in Chapter VIII and footnotes *ibid.*

CANADA YEAR BOOK. Published annually by the Department of Trade and Commerce, Census and Statistics Office, Ottawa. In progress.

CANADIAN ALMANAC AND MISCELLANEOUS DIRECTORY. Published annually. Contains Commercial, Statistical, Astronomical, Departmental, Ecclesiastical, Educational, Financial and General Information. Commencing 1848 (Scobies). Toronto. In progress.

CANADIAN ANNUAL REVIEW. Toronto, 1901. In progress.

Note—This is a comprehensive publication dealing with foreign relations ; with Dominion, provincial, inter-provincial and municipal affairs ; also with such subjects as Transportation, Finance, Industry, Canadian Development and Resources, Literature, Journalism, Art, Public Events, Incidents, etc.

CONFERENCE OF GOVERNORS. *Proceedings of a Conference of Governors in the White House, Washington, D.C., May 13-15, 1908.* Washington, 1909. xxxvii+451 pp., 8vo. 60th Cong., 2nd Sess., House doc. No. 1425.

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Water-Powers of Canada, by Leo. G. Denis and Arthur V. White. 8vo, 397 pp., maps and plates. Ottawa, 1911
Note—Contains *Bibliography, pp. 347-376.*

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Forests of British Columbia, by H. N. Whitford and Roland D. Craig, under the direction of Clyde Leavitt, Chie Forester, Commission of Conservation. 8vo, viii+409 pp., maps and illus. Ottawa, 1918.

Water Works and Sewerage Systems of Canada, by Leo. G. Denis. 8vo, 176 pp., illus. Ottawa, 1916.
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Electric Generation and Distribution in Canada, by Leo. G. Denis. 8vo, 296 pp., illus. Ottawa, 1918.

Long Sault Rapids, St. Lawrence River. An Enquiry into the Constitutional and Other Aspects of the Project t Develop Power Therefrom, by Arthur V. White. 8vo, 384 pp., maps and plates. Ottawa, 1913.

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DEPARTMENT OF THE INTERIOR—WATER POWER BRANCH. Consult *Water Resources Papers*, pub lished by the Department of the Interior, Canada, Dominion Water Power Branch.
Note—Of the *Water Resources Papers* relating to British Columbia No 8, 14, 18 and 21, dealing mor particularly with stream-flow data, are specifically described in Chapter XV "Stream-flow Data"; others which include references to water-powers in British Columbia are as follows:

Water Resources Paper No. 12—Report on Small Water-Powers in Western Canada and discussion of Sources o Power for the Farm, by A. M. Beale. 8vo, 32 pp., illus. Ottawa, 1915.

Water Resources Paper No. 13—Report on the Coquitlam-Buntzen Hydro-Electric Development, British Col umbia, by G. R. G. Conway. 8vo, 51 pp., illus. Ottawa, 1915.

Water Resources Paper No. 16—Water Powers of Canada. A series of five pamphlets in one volume covering the water-power situation in Canada, prepared for distribution at the Panama-Pacific Exposition, San Fran cisco, 1915. The section relating to British Columbia is by G. R. G. Conway and consists of 157 pp., 8vo with numerous illustrations especially of the developed powers. Ottawa, 1916.

Water Resources Paper No. 17—Canadian Hydraulic Power Development and Electric Power in Canadian In dustry, by Charles H. Mitchell. 8vo, 50 pp., illus. Ottawa, 1916.

DEPARTMENT OF THE INTERIOR—IRRIGATION BRANCH. Consult the *Annual Reports* of the Depart ment of the Interior, Canada. The first *Annual Report* regarding irrigation surveys was issued in 1894 and subsequently reports have been issued covering the years 1895, 1896, 1897, 1898, 1902, 1906-7, 1908 and annually. In progress.

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Note—No reports have yet been issued.

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PACIFIC RAILWAY SURVEYS: *Reports of Explorations and Surveys to Ascertain the Most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean.* Made under the Direction of the Secretary of War, in 1853-6, according to Acts of Congress of March 31, 1853, May 31, 1854, and August 5, 1854. 4to, 13 vols., with topographical maps, profiles, sketches and plates. Washington, 1855-1861.

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LEGISLATION : For Proclamations, Regulations, Statutes, etc., consult in Chapter III *supra* "Chronological Key to Water Legislation in British Columbia," pp. 104 *et seq,* also footnotes *ibid.* For Bibliography relating to the Law of Waters, see *Water-Powers of Canada,* 1911, pp. 372-376, Commission of Conservation, Ottawa, 1911 ; also "Bibliography Relating to the Law of Waters," by Arthur V. White in *The Canadian Law Times,* Vol. XXXII, No. 7 (Toronto, July, 1912), pp. 549-560.

Message Relative to the Terms of Union with the Province of British Columbia. 8vo, 66 pp. Ottawa, 1873.

II—GUIDES, HANDBOOKS AND OTHER PUBLICATIONS GIVING DESCRIPTIVE INFORMATION AND HISTORICAL DATA RELATING TO VARIOUS NATURAL RESOURCES OF THE PROVINCE

BRITISH COLUMBIA GUIDE BOOKS for years 1877-78, 1897, 1903 and 1911 as follows :

Note—These books contain much valuable historical and other data relating to the provincial natural resources.

GUIDE TO THE PROVINCE OF BRITISH COLUMBIA FOR 1877-8, *Compiled from the Latest and Most Authentic Sources of Information.* 8vo, 410 pp. Victoria, B.C., 1877.

YEAR BOOK OF BRITISH COLUMBIA AND MANUAL OF PROVINCIAL INFORMATION. *To which is added a chapter containing much special information respecting the Canadian Yukon and Northern Territory generally ;* by R. E. Gosnell. 8vo, 406 pp., numerous illustrations. Victoria, B.C., 1897.

YEAR BOOK OF BRITISH COLUMBIA AND MANUAL OF PROVINCIAL INFORMATION, by R. E. Gosnell. 8vo, 394 pp., numerous illustrations, sketch map of the Province and table showing mineral production. Victoria, B.C., 1903.

YEAR BOOK OF BRITISH COLUMBIA AND MANUAL OF PROVINCIAL INFORMATION (Coronation Edition), by R. E. Gosnell. 8vo, 358 pp., numerous illustrations. Victoria, 1911.

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NEW GOVERNMENT COLONY, THE—*British Columbia and Vancouver Island. A complete Hand-Book replete with the latest information concerning the newly-discovered Gold Fields.* Anonymous. 8vo, 67 pp., map. London, 1858.

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Note—[illegible]au issues numerous Bulletins dealing with natural resources, such as agricultural opportunities, [illegible]tc. For example, with respect to the sporting resources, consult Bulletins No. 17, *Game of British Col[illegible] ;* No. 20, *Fisheries of British Columbia ;* and No. 25, *The Game Fishes of British Columbia.*

CORNWALLIS, KINAHAN. *The New El Dorado, or British Columbia.* 8vo, 405 pp., map and plate. London, 1858.

DYER, E. JEROME. *The Routes and Mineral Resources of North Western Canada.* 8vo, 268 pp., maps. London, 1898.

FORBES, CHARLES. *Vancouver Isla[illegible] : its Resources and Capabilities as a Colony.* A Prize Essay. 8vo, 63 pp. +Appendix 18 pp. Published by the Colonial Government, 1862.

GOLD FIELDS. Apart from its use for domestic and incidental agricultural purposes, water was first extensively employed in British Columbia in connection with the mining industry. For information respecting mining, consult the Reports of the Minister of Mines, British Columbia ; the Reports of the Geological Survey of Canada ; the various Histories, Guides and Handbooks of the Province ; consult also items in this section under Ballantyne, Boam, Cornwallis, Dyer, Haslitt, and, under Section IV, Butler, Chittenden, McNaughton, Ogilvie, etc.

HALL, E. HEPPLE. [illegible] *of Plenty: British North America for Health, Sport and Profit, a Book for all Travellers and Settlers.* [illegible], 192 pp., large map. London, 1879.

Note—See Chapter VI for British Columbia.

HAZLITT, WILLIAM CAREW. *The Great Gold Fields of Cariboo : with an authentic description, brought down to the latest period, of British Columbia and Vancouver Island.* sm. 8vo, 184 pp., map. London, 1862.

LANGEVIN, HON. H. L., Minister of Public Works, Canada. *British Columbia Report.* 8vo, 246 pp. Ottawa, 1872.

MACKENZIE RIVER BASIN. *Third Report of the Select Committee of the Senate appointed to inquire into the resources of that part of the Dominion lying north of the Saskatchewan watershed, east of the Rocky Mountains and west of Hudson Bay, and comprising the Great Mackenzie Basin—its extent of navigable rivers, lakes and sea coast, of arable and pastoral land, its fisheries, forests and mines, and to report upon its possible commercial and agricultural value.* 8vo, 310 pp., maps. Ottawa, 1888.

Note—It will be observed that this Mackenzie River Report is referred to as the *Third* Report. It is interesting to know that the First and Second Reports are merely preliminary, and consist chiefly of requests to the Senate for authority to procure evidence, employ clerical assistance, etc. They are published

in the *Senate Journals* for 1888 at pp. 79 and 83, respectively. Fourth and Fifth Reports dealing with matters of services and publication were also minor reports, see *Senate Journals* for 1888, pp. 176 and 267.

In the session of 1891, a report by a Select Committee of the Senate recommended that certain documents and letters be printed as a supplement to the Third Report of 1888. These actually are published as Appendix No. 1 (71 pp.), to the *Senate Journals*, 1891.

In the session of 1906-07 a report of a Committee to enquire respecting the Northern parts of Alberta, Saskatchewan and Mackenzie territory, etc., was published with evidence, as Appendix No. 1 to the *Senate Journals*, 1906-7. It consists of 128 pp. and a number of photographic plates.

OGILVIE, WILLIAM, D.L.S. *Information respecting the Yukon District*, from the Reports of; and from other sources. 8vo, 65 pp., maps and illus. Department of Interior, Ottawa, 1897.

PEACE RIVER DISTRICT OF BRITISH COLUMBIA. *Return* to an order of the House of Commons, dated the 18th Feb., 1907, for a copy of the Report respecting the selection and location of 3,500,000 acres in the Peace River District of British Columbia, which has been prepared upon the exploratory survey mentioned by the Minister of the Interior on the 7th February, in the House of Commons. 6-7 Ed. VII. *Dominion Sessional Paper No. 178.* 8vo, 40 pp. Ottawa, 1907.

UNEXPLOITED WEST, THE. A compilation of all available information as to the resources of Northern and North-western Canada. By Ernest J. Chambers, Major, Corps of Guides. Published under the direction of F. C. C. Lynch, Superintendent, Railway Lands Branch, Department of the Interior, Ottawa, 1914. Lge. 8vo, xv+361 pp.+Bibliography, viii+Index, xi pp.

YUKON TERRITORY, THE; its History and Resources. Issued by direction of the Hon. Frank Oliver, Minister of the Interior. 8vo, 140 pp., illus. Ottawa, 1907.

NOTE—For cognate information, consult also the following. Under "General," Section I: Handbook of Canada, B. C. Pilot; Under "Topography," Section III: Annual Reports dealing with Lands, Mines and Fisheries; Under "Travel," Section IV: Chittenden, Jennings, Talbot, etc.; Under "History," Section V: Haslitt, Macdonald, Macfie, Mayne, Pemberton, Rattray, Scholefield.

III—TOPOGRAPHY: GOVERNMENT AND OTHER PUBLICATIONS CONTAINING DESCRIPTIONS OF THE PHYSICAL CHARACTERISTICS OF VARIOUS WATERSHEDS

(Consult also under 'Guides and Handbooks' above, and under 'Travel and Exploration' below.)

GEOLOGICAL SURVEY OF CANADA, Consult the Annual Reports, Special Reports and Memoirs. References to British Columbia will be found as follows:

Publication No.

Note—The numbers in brackets are the publication numbers of the reports when issued as separates.

84 *Report of Progress*, 1871-72

Journal and Report of Preliminary Explorations in British Columbia, by A. R. C. Selwyn; pp. 16-72.

Note—Route followed was by Fraser and Thompson rivers to Kamloops, thence by the North Thompson and McLennan rivers to Tête Jaune Cache.

On the Coal Fields of the East Coast of Vancouver Island, by J. Richardson; pp. 73-100

89 *Report of Progress*, 1872-73

" " Coal Fields of Vancouver and Queen Charlotte Islands, by J. Richardson; pp. 32-65.

95 *Report of Progress*, 1873-74

On Geological Explorations in British Columbia, by J. Richardson; pp. 94-102.

Note—Refers to coal deposits and geology of Vancouver island, and smaller islands in strait of Georgia.

101 *Report of Progress*, 1874-75

On Explorations in British Columbia, by J. Richardson; pp. 71-83.

Note—Treats of a partial examination of several channels and islands on mainland coast, Graham reach, Gardner canal, Douglas channel to Wrangel in Alaska; also of the south-eastern portion of Nanaimo coal-basin.

108 *Report of Progress*, 1875-76

Report on Exploration in British Columbia, with sketch-map of route, by A. R. C. Selwyn; pp. 28-86.

Note—Route followed was from Quesnel to Stuart lake *via* Telegraph trail; thence to McLeod lake and down Parsnip and Peace rivers to mouth of Smoky river. Return *via* Giscome portage and Fraser river; also describes first 45 miles of South Pine river to forks.

Report on Explorations in British Columbia, by G. M. Dawson; pp. 233-265.

Note—Reconnaissance examination. Route: From Soda creek, *via* Chilcotin river to Tatlayoko lake, thence Chilanko, Nazko, Blackwater, and Chilako rivers to Prince George and down Fraser river to Quesnel.

114 *Report of Progress*, 1876-77

Report on Explorations in British Columbia, chiefly in the Basins of the Blackwater, Salmon [Dean] and Nechako Rivers, and on François Lake, by G. M. Dawson; pp. 17-94; with coloured geological map No. 120.

Report of a Reconnaissance of Leech River and Vicinity, by G. M. Dawson; pp. 95-102.

Note—Leech river is tributary to Sooke river and is about 21 miles from Victoria.

(115) General Note on the Mines and Minerals of Economic Value of British Columbia, with a list of Localities, by G. M. Dawson; pp. 103-149.

Note—Reprinted with additions and alterations, from the Canadian Pacific Railway Report, 1877.

Report on the Coal Fields of Nanaimo, Comox, Cowichan, Burrard Inlet and Sooke, British Columbia, by J. Richardson; pp. 160-192; with Map No. 121.

125 *Report of Progress*, 1877-78

Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia, by G. M. Dawson; Section B—173 pp., with coloured Geological map No. 127.
Note—District covered approximately bounded in longitude by 119° to 121°-30′, in latitude from 49th parallel to 51°-20′.

132 *Report of Progress*, 1878-79

(133) Report on the Queen Charlotte Islands, by G. M. Dawson; Section B—239 pp., with two coloured geological maps and sketches of harbours; Maps Nos. 139, 140 and 141.

147 *Report of Progress*, 1879-80

Report on an Exploration from Fort Simpson, on the Pacific Coast, to Edmonton, on the Saskatchewan, embracing a portion of the Northern part of British Columbia and the Peace River Country, by G. M. Dawson; Section B—165 pp., with a map in three sheets, with geological indications; Maps Nos. 150, 151, 152.

Note on the Distribution of some of the more Important Trees of British Columbia, by G. M. Dawson; Section B—pp. 167-177, with Map No. 149.
Note—First printed in *Canadian Naturalist*, Vol. IX, No. 9.

167 *Report of Progress*, 1882-83-84

Report on the Geology of the Country near the Forty-ninth Parallel of North Latitude, West of the Rocky Mountains, from Observations made 1859-60, by H. Bauerman; Section B—42 pp., with plates of sections No. 170.

210 *Annual Report* (New Series), Vol. I, 1885

(212) Preliminary Report on the Physical and Geological Features of that portion of the Rocky Mountains between Latitudes 49° and 51°-30′, by G. M. Dawson; Section B—169 pp., with two coloured geological maps, Nos. 223 and 224.

233 *Annual Report* (New Series), Vol. II, 1886

(235) Report on a Geological Examination of the Northern Part of Vancouver Island and Adjacent Coasts, by G. M. Dawson; Section B—129 pp., with a coloured geological map, No. 247.

(236) On the Geological Structure of a Portion of the Rocky Mountains, by R. G. McConnell; Section D—41 pp., with geological section No. 248.
Note—Section is in vicinity of Canadian Pacific railway near the 51st parallel.

258 *Annual Report* (New Series), Vol. III, 1887-88

(260) Report on an Exploration in the Yukon District, N.W.T., and Adjacent Northern Portion of British Columbia, by G. M. Dawson; Section B—277 pp., with an index map, No. 274, and a detailed map in three sheets, with Geological Indications. Maps Nos. 275, 276, 277.

(263) Report on the Geology of the Mining District of Cariboo, by A. Bowman; Section C—49 pp., with geological sections and maps Nos. 278, 279, 280, 281.

(271) The Mineral Wealth of British Columbia—With an Annotated List of Localities of Minerals of Economic value, by G. M. Dawson; Section R—163 pp.

292 *Annual Report* (New Series), Vol. IV, 1888-89

(294) Report on a portion of the West Kootenay District, by G. M. Dawson; Section B—66 pp., with map No. 303.

(295) Report on an Exploration in the Yukon and Mackenzie Basins; by R. G. McConnell; Section D—163 pp., with map No. 304.
Note—Describes the Liard river from Dease river to Fort Simpson, pp. 33-50.

581 *Annual Report* (New Series), Vol. VII, 1894

(573) Report on the Area of the Kamloops Map Sheet, by G. M. Dawson; Section B—427 pp., with Maps Nos. 556 and 557.

(574) Report on an Exploration of the Finlay and Omineca rivers, by R. G. McConnell; Section C—40 pp., with Map No. 567.
Note—Describes these two rivers in detail.

715 *Annual Report* (New Series), Vol. XI, 1898

(703) Report on the Geology and Natural Resources of the Country Traversed by the Yellow Head Pass Route from Edmonton to Tête-Jaune Cache, comprising portions of Alberta and British Columbia, by James McEvoy; Section D—44 pp., with map No. 676.

782 *Annual Report* (New Series), Vol. XII, 1899

(743) Report on the Atlin Mining District, British Columbia, by J. C. Gwillim; Section B—48 pp., with map No. 742.
Note—Gives fall respectively of many of the creeks.

952 *Annual Report* (New Series), Vol. XVI, 1904

(940) Report on Graham Island, B.C., by R. W. Ells; Section B—46 pp., with two maps, Nos. 921 and 922.
Note—In this exploration particular attention was given to the coal areas of the interior.

629 Report on Explorations in the Yukon and Adjacent Northern Portion of British Columbia in 1887, with extracts relating to the Yukon District from report on an exploration in the Yukon and Mackenzie Basins, 1887-88, by R. G. McConnell. G. M. Dawson.

939 Preliminary Report on the Rossland, B.C., Mining District, 1906, by R. W. Brock; 40 pp.

986 Preliminary Report on a part of the Similkameen District, B.C., 1907, by Charles Camsell; 41 pp., with map No. 987.

988 The Telkwa River and Vicinity, B. C., 1907, by W. W. Leach; 23 pp., with map No. 989.

996 Preliminary Report on a Portion of the Main Coast of British Columbia, and Adjacent Islands included in New Westminster and Nanaimo districts, 1908, by O. E. LeRoy; 59 pp., 4 pls., 6 figs., one map No. 997.

1035 Report on Coal Fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia, by D. B. Dowling.

Report on the Climate and Agricultural Value, General Geological Features and Minerals of Economic Importance of Part of the Northern Portion of British Columbia and the Peace River Country, by G. M. Dawson. (Reprinted from the Canadian Pacific Railway Report for 1880.) lge. 8vo, 25 pp.

Geological Record of the Rocky Mountain Region of Canada, by G. M. Dawson. (Reprinted from th Bulletin of the Geological Society of America, Vol XII, pp. 57-92, February 25, 1901).

GUIDE BOOKS ISSUED BY THE GEOLOGICAL SURVEY

Guide Book No. 8. Toronto to Victoria and return *via* Canadian Pacific and Canadian Northern Railways— Parts 1, 2 and 3. sm. 8vo, 386 pp., maps and illus. Ottawa, 1913.

Guide Book No. 9. Toronto to Victoria and return *via* Canadian Pacific, Grand Trunk Pacific and Nationa Transcontinental Railways. sm. 8vo, 164 pp., maps and illus. Ottawa, 1913.

Guide Book No. 10. Excursions in Northern British Columbia and Yukon Territory and along the North Pacifi Coast. sm. 8vo, 179 pp., maps and illus. Ottawa, 1913.

LIST OF THE PRINCIPAL REPORTS RELATING TO WORK IN BRITISH COLUMBIA WHICH ARE INCLUDED IN THE "DIRECTOR'S SUMMARY REPORTS" SINCE 1894.

Note—The publication numbers given are of the Summary Reports printed separately.

553 *Annual Report* (New Series), Vol. VII, 1894
- Kamloops District, Economic Minerals in the—G. M. Dawson.................Part A. pp. 14- 38

583 *Annual Report* (New Series), Vol. VIII, 1895
- West Kootenay District—R. G. McConnell.................Part A. pp. 22- 37

614 *Annual Report* (New Series), Vol. IX, 1896
- West Kootenay District—R. G. McConnell.................Part A. pp. 18- 30

644 *Annual Report* (New Series), Vol. X, 1897
- West Kootenay District—R. G. McConnell.................Part A. pp. 27- 33

674 *Annual Report* (New Series), Vol. XI, 1898
- Yukon District and Adjacent Parts of British Columbia—J. B. Tyrrell.................Part A. pp. 36- 46
- West Kootenay District—R. W. Brock.................Part A. pp. 62- 71
- Yellowhead Pass District—J. McEvoy.................Part A. pp. 72- 86

691 *Annual Report* (New Series), Vol. XII, 1899
- Atlin District—J. C. Gwillim.................Part A. pp. 52 -75
- West Kootenay District—R. W. Brock.................Part A. pp. 75- 86
- East Kootenay District—J. McEvoy.................Part A. pp. 87-103

717 *Annual Report* (New Series), Vol. XIII, 1900
- Atlin District—J. C. Gwillim.................Part A. pp. 52- 62
- West Kootenay District—R. W. Brock.................Part A. pp. 62- 84
- East Kootenay District—J. McEvoy.................Part A. pp. 84- 95

762 *Annual Report* (New Series), Vol. XIV, 1901
- International Boundary, Geology of the Region adjoining the—R. A. Daly.................Part A. pp. 39- 51
- Boundary Creek District—R. W. Brock.................Part A. pp. 51- 69
- Crowsnest Coal Field—W. W. Leach.................Part A. pp. 69- 81

817 *Annual Report* (New Series), Vol. XV, 1902-3
- Vancouver Island, Geology of the West Coast of—Arthur Webster.................Part A. pp. 54- 76
- Vancouver Island, Geology of the West Coast of—Ernest Haycock.................Part A. pp. 76- 92
- Boundary Creek District, Preliminary Report on the—R. W. Brock.................Part A. pp. 92-138
- International Boundary, Geology of the Western Part of the—R. A. Daly.................Part A. pp. 138-149

866 *Annual Report* (New Series), Vol. XV, 1902-3
- The Lardeau District—R. W. Brock.................Part AA. pp 42- 81
- Peace River Country—J. M. Macoun.................Part AA. pp. 81- 83
- On the Coal Basins in the Rocky Mountains—D. B. Dowling.................Part AA. pp. 83- 91
- International Boundary, Geology of the—R. A. Daly.................Part AA. pp. 91-100

900 *Annual Report* (New Series), Vol. XVI, 1904
- Nicola Coal Basin—R. W. Ells.................Part A. pp. 42- 65
- Quilchena Coal Basin—R. W. Ells.................Part A. pp. 65- 74
- Copper Claims of Aspen Grove—R. A. A. Johnston.................Part A. pp. 74- 78
- Copper Claims of Aberdeen Camp—R. A. A. Johnston.................Part A. pp. 78- 80
- The Lardeau Mining District—R. W. Brock.................Part A. pp. 80- 91
- International Boundary, Geology of the Western Part of the—R. A. Daly.................Part A. pp. 91-100
- Natural History of the National Park—John Macoun.................Part A. pp. 100-105
- Cascade and Costigan Coal Basins and Their Continuation Northward—D. B. Dowling.................Part A. pp. 105-116
- The Costigan Coal Basin—D. B. Dowling.................Part A. pp. 116-121

NOTE—After the year 1904, the Annual Reports ceased to be published in one volume, and the Director's Summary Reports were issued separately. The following are the chief references in the Summary Reports to work performed in British Columbia:

947 *Summary Report* for the Calendar Year 1905
- Northwestern British Columbia and Windy Arm District—R. G. McConnell.................pp. 26- 32
- Unuk River Mining Region—F. E. Wright.................pp. 46- 53
- Graham Island—R. W. Ells.................pp. 53- 55
- Nanaimo-Comox Coal Field—H. S. Poole.................pp. 55- 59

959 *Summary Report* for the Calendar Year 1906
- New Westminster District and Texada Island, Surveys in—O. E. LeRoy.................pp. 31- 34
- Telkwa Mining District—W. W. Leach.................pp. 35- 42
- Similkameen District—Charles Camsell.................pp. 43 55
- Rossland Mining District, Operations in the—R. W. Brock.................pp. 56- 63
- Surface Geology of British Columbia and the Great Plains, etc.—R. Chalmers.................pp. 74- 80

Summary Report for the Calendar Year 1907
- Powell River to Kingcome Inlet—J. A. Bancroft.................pp. 16- 18
- The Bulkley Valley—W. W. Leach.................pp. 19- 23
- Camp Hedley—C. Camsell.................pp. 24- 31
- The Lardeau District—R. W. Brock.................pp. 34- 90

1072 ***Summary Report*** **for the Calendar Year 1908**
- Coast from Kingcome Inlet to Dean Channel, including the Adjacent Islands, Geology of the—R. P. D. Graham .... pp. 39- 40
- Bulkley Valley and Vicinity—W. W. Leach .... pp. 41- 45
- Texada Island, North-western Portion of—R. G. McConnell .... pp. 46- 50
- Texada Island, Topographical Work on—F. H. MacLaren .... p. 51
- Vancouver Island, Explorations on the South-eastern Portion of—Charles H. Clapp .... pp. 52- 60
- Osoyoos and Similkameen Mining Divisions—Charles Camsell .... pp. 61- 64
- Phoenix Camp and Slocan District—O. E. LeRoy .... pp. 65- 68
- Phoenix, Topographical Work at—W. H. Boyd .... p. 69

1120 ***Summary Report*** **for the Calendar Year 1909**
- Skeena River District—W. W. Leach .... pp. 61- 68
- Texada Island and Moresby Island—R. G. McConnell .... pp. 69- 83
- Southern Vancouver Island—Chas. H. Clapp .... pp. 84- 97
- Saltspring Island and East Coast of Vancouver Island—J. A. Allan .... pp. 98-102
- Vancouver Island, Topographic Work on—R. H. Chapman .... p. 103
- Tulameen District—Charles Camsell .... pp. 104-117
- Beaverdell District, West Fork Kettle River—L. Reinecke .... pp. 118-122
- Upper Fraser River between Prince George and Tête-Jaune Cache, Reconnaissance on—G. S. Malloch .... pp. 123-130
- Slocan District—O. E. LeRoy .... pp. 131-133
- Slocan District, Topographical Work in the—W. H. Boyd .... p. 134
- East Kootenay, Reconnaissance in—Stuart J. Schofield .... pp. 135-138

1170 ***Summary Report*** **for the Calendar Year 1910**
- Atlin District, Portions of—D. D. Cairnes .... pp. 27- 58
- Portland Canal District—R. G. McConnell .... pp. 59- 89
- Portland Canal District, Topographical Work in the—G. S. Malloch .... p. 90
- Skeena River District—W. W. Leach .... pp. 91-101
- Victoria and Saanich Quadrangles, Vancouver Island, Geology of the—C. H. Clapp .... pp. 102-109
- Vancouver Island, Topographical Work on—R. H. Chapman .... p. 110
- Similkameen and Tulameen Districts, Parts of the—Charles Camsell .... pp. 111-119
- Beaverdell District, West Fork of Kettle River—L. Reinecke .... pp. 120-122
- Slocan District—O. E. LeRoy .... pp. 123-128
- Slocan and Deadwood Districts, Topographical Work in the—W. H. Boyd .... p. 129
- East Kootenay, Cranbrook Sheet, Reconnaissance in—Stuart J. Schofield .... pp. 130-134
- Ice River District—John A. Allan .... pp. 135-144

1218—***Summary Report*** **for the Calendar Year 1911**

Reports from Geological Division:
- Observatory Inlet, Report I—R. G. McConnell .... pp. 41- 50
- Salmon River District, Report II—R. G. McConnell .... pp. 50- 56
- Portland Canal District, Report III—R. G. McConnell .... pp. 56- 71
- Upper Skeena River, between Hazelton and the Groundhog Coal Field, Reconnaissance on the—G. S. Malloch .... pp. 72- 90
- Nanaimo Sheet, Nanaimo Coal Field, Vancouver Island, Geology of, Report I—Charles H. Clapp .... pp. 91-105
- Comox and Suquash Coal Fields, Vancouver Island, Notes on the Geology of the, Report II—Charles H. Clapp .... pp. 105-107
- Fraser Cañon and Vicinity, Report I—Charles Camsell .... pp. 108-111
- Lillooet Mining Division, Yale District, Geology of a Portion of, Report II—Charles Camsell .... pp. 111-115
- Skagit Valley, Yale District, Geology of, Report III.—Charles Camsell .... pp. 115-123
- Diamonds at Tulameen and Scottie Creek, near Ashcroft, Notes on the Occurrence of, Report IV—Charles Camsell .... pp. 123-124
- Fraser Cañon and Vicinity, Geology of Siwash Creek Area—A. M. Bateman .... pp. 125-129
- Beaverdell Map-area, Yale District—L. Reinecke .... pp. 130-132
- Franklin Mining Camp, West Kootenay—C. W. Drysdale .... pp. 133-138
- Nelson Map-area, Geology of—O. E. LeRoy .... pp. 139-157
- East Kootenay, Reconnaissance in—Stuart J. Schofield .... pp. 158-164
- Shuswap Lakes and Vicinity, Reconnaissance of the—Reginald A. Daly .... pp. 165-174
- Field Map-area, Yoho Park, Geology of—John A. Allan .... pp. 175-187
- Kicking Horse Valley, Cambrian of the—Charles D. Walcott .... pp. 188-191

Reports from Topographical Division:
- Alberni Sheet, Vancouver Island—R. H. Chapman .... p. 366
- Cowichan Sheet, Vancouver Island—K. G. Chipman .... p. 366
- Columbia-Kootenay Triangulation—S. C. McLean .... p. 367
- Slocan Map-area—A. C. T. Sheppard .... p. 368

1305 ***Summary Report*** **for the Calendar Year 1912**

Reports from Geological Division:
- Graham Island, Queen Charlotte Group, Geological Reconnaissance on—Charles H. Clapp .... pp. 12- 40
- Sooke and Duncan Map-areas, Vancouver Island, Geology of Portions of the—Charles H. Clapp .... pp. 41- 54
- Grand Trunk Pacific Railway, from Prince Rupert to Aldermere, Geological Section along the—R. G. McConnell .... pp. 55- 62
- Princess Royal Island—R. G. McConnell .... pp. 63- 67
- Texada Island—R. G. McConnell .... p. 68
- Groundhog Coal Field—G. S. Malloch .... pp. 69-101
- Hazelton, Metalliferous Deposits in the Vicinity of—G. S. Malloch .... pp. 102-107
- Fraser River Valley, from Lytton to Vancouver, A Geological Reconnaissance of the—Norman L. Bowen .... pp. 108-114
- Thompson River Valley below Kamloops Lake, Geology of the—Chas. W. Drysdale .... pp. 115-150
- Savona Map-area—Bruce Rose .... pp. 151-155
- Selkirk and Purcell Mountains at the Canadian Pacific Railway (Main Line), Geology of the—Reginald A. Daly .... pp. 156-164
- Rocky Mountain Section between Banff, Alta., and Golden, B.C., along the Canadian Pacific Railway—John A. Allan .... pp. 165-176
- Lillooet and Chilko Lake, Exploration Between—A. M. Bateman .... pp. 177-187
- Lillooet Map-area—A. M. Bateman .... pp. 188-210
- Yale District, The Geology of Certain Portions of—Charles Camsell .... pp. 211-220
- East Kootenay, Reconnaissance in—Stuart J. Schofield .... pp. 221-228

NOTE—The annual Summary Report of the Geological Survey is now issued in parts, each designated by a letter of the alphabet, which, in the case of the last part, is followed by the words "AND LAST." Part A contains the report of the Directing Geologist, reviewing the work of the Geological Survey for the year and containing lists of reports and maps published during the year, and is accompanied by a table of contents for all parts of the annual Summary Report.

NOTE—Since 1910, certain reports issued by the Geological Survey have been called 'memoirs' and have been numbered Memoir 1, Memoir 2, etc. Owing to delays incidental to the publishing of reports and their accompanying maps, not all of the reports have been called memoirs, and the memoirs have not been [redacted] in order of their assigned numbers. Information respecting British Columbia will be found in the following:

1093 *Memoir 2*—Geology and Ore Deposits of Hedley Mining District, B.C., 1910, by Charles Camsell; 218 pp., 20 pls.; 8 figs., 4 maps Nos. 1095, 1096, 1105, 1106.

1139 *Memoir 11*—Triangulation and Spirit Levelling of Vancouver Island, B.C., 1909, by R. H. Chapman; 31 pp., diagram.

1121 *Memoir 13*—Southern Vancouver Island, 1912, by Charles H. Clapp; 208 pp., 18 pls., 3 figs., 1 map No. 1123 (17A).

1166 *Memoir 19*—Geology of Motherlode and Sunset Mines, Boundary District, B.C., 1914, by O. E. LeRoy; 56 pp., 5 pls., 3 figs., 2 maps Nos. 1167 (29A), 1168 (30A).

1175 *Memoir 21*—The Geology and Ore Deposits of Phoenix, Boundary District, B.C., 1912, by O. E. LeRoy; 110 pp., 7 pls., 18 figs., two maps Nos. 1135 (15A), 1136 (16A).

1188 *Memoir 23*—Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C., 1914, by J. Austin Bancroft; 152 pp., 17 pls., 5 figs., 1 diag., 1 map No. 1241 (65A).

1204 *Memoir 24*—Preliminary Report on the Clay and Shale Deposits of the Western Provinces, 1912, by Heinrich Ries and Joseph Keele; 231 pp., 61 pls., 10 figs., 1 map No. 1201 (51A).

1279 *Memoir 25*—Report on the Clay and Shale Deposits of the Western Provinces, Part II., 1914, by Heinrich Ries and Joseph Keele; 105 pp., 40 pls., 6 figs.

1206 *Memoir 26*—Geology and Mineral Deposits of the Tulameen District, B.C., 1913, by C. Camsell, 188 pp., 23 pls., 2 figs., 4 maps Nos. 1195 (45A), 1196 (46A), 1197 (47A), 1198 (48A).

1235 *Memoir 32*—Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., 1914, by R. G. McConnell; 101 pp., 7 pls., 3 figs., 2 diags., with two maps Nos. 1164 (28A), 1200 (50A).

1293 *Memoir 36*—Geology of the Victoria and Saanich Map-areas, Vancouver Island, B.C., 1914, by C. H. Clapp; 143 pp., 18 pls., 6 figs., and 4 maps Nos. 1251 (70A), 1252 (71A), 1253 (72A), 1254 (73A.)

1255 *Memoir 37*—Portions of the Atlin District, B.C., 1913, by D. D. Cairnes; 129 pp., 32 pls., 5 figs., 4 diags. 1 map No. 1283 (94A) (Preliminary).

1203 *Memoir 38*—Geology of the North American Cordillera at the Forty-ninth Parallel, Parts I and II, 1913, by Reginald Aldworth Daly, 857 pp., 73 pls., 42 figs.; and in Part III, 17 geological maps, with structure sections and two sheets of photographic panoramas.

1324 *Memoir 47*—Clay and Shale Deposits of the Western Provinces, Part III, 1914, by Heinrich Ries, 73 pp., 11 pls., 8 figs.

1344 *Memoir 51*—Geology of the Nanaimo Map-area, 1914, by C. H. Clapp; 135 pp., 13 pls., 10 figs., and 4 maps Nos. 1179 (33A), 1568 (158A), 1569 (159A), 1570 (160A).

1363 *Memoir 53*—Coal Fields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia (revised edition) 1914, by D. B. Dowling; 142 pp., 9 pls., 1 map No. 1321 (55A).

1370 *Memoir 55*—Geology of Field Map-area, British Columbia and Alberta, 1914, by John A. Allan; 312 pp. 21 pls., 5 figs., 1 map No. 1445 (142A).

1383 *Memoir 56*—Geology of Franklin Mining Camp, B.C., 1915, by Charles W. Drysdale; 246 pp., 23 pls., 16 figs., 2 maps Nos. 1286 (97A), 1381 (133A).

1386 *Memoir 58*—Texada Island, 1915, by R. G. McConnell, 112 pp., 8 pls., 1 fig., maps and plans Nos. 1313 (109A) 1314 (110A), 1319 (111A), 1320 (112A) and 1321.

1388 *Memoir 59*—Coal Fields and Coal Resources of Canada, 1915, by D. B. Dowling, 174 pp., 9 figs., 7 maps Nos. 125A to 131A, publications Nos. 1372 to 1378 inclusive.

1453 *Memoir 65*—Clay and Shale Deposits of the Western Provinces, Part IV, 1915, by H. Ries; 83 pp., 8 pls., 18 figs.

1455 *Memoir 66*—Clay and Shale Deposits of the Western Provinces, Part V, 1915, by J. Keele; 74 pp., 8 pls.

1463 *Memoir 68*—A Geological Reconnaissance between Golden and Kamloops, B.C., along the line of the Canadian Pacific Railway, 1915, by R. A. Daly; 260 pp., 46 pls., 4 figs., 7 maps Nos. 1446 (143A), 1447, 1448, 1449, 1450, 1457, 1458.

1465 *Memoir 69*—Coal Fields of British Columbia, 1915, by D. B. Dowling; 349 pp., 23 diags., 1 map No. 1412 (139A).

1505 *Memoir 76*—Geology of the Cranbrook Map-area, B.C., 1915, by Stuart J. Schofield; 245 pp., 33 pls., 15 figs., 1 map No. 1528 (147A).

1520 *Memoir 77*—Geology and Ore Deposits of Rossland, B.C., 1915, by C. W. Drysdale; 317 pp., 25 pls., 26 figs., 6 maps Nos. 1001, 1002, 1003, 1004, 1496 (146A), 1518.

1537 *Memoir 79*—Ore Deposits of the Beaverdell Map-area, B.C., 1915, by L. Reinecke; 178 pp., 13 pls., 9 figs., 1 map No. 1183 (37A).

1039 *Memoir 87*—Geology of the Flathead Coal Basin, B.C., 1916, by J. D. MacKenzie; 53 pp., 1 pl., 1 fig., 2 maps Nos. 1583 (166A), 1629 (182A).

1622 *Memoir 88*—Geology of Graham Island, B.C., 1916, by J. D. MacKenzie; 221 pp., 16 pls., 23 figs., 2 maps Nos. 1597 (176A), 1598 (177A).

1651 *Memoir 94*—Ymir Mining Camp, B.C., 1917, by C. W. Drysdale; 185 pp., 15 pls., 16 figs., 1 map No. 1594 (175A).

1660 *Memoir 96*—Sooke and Duncan Map-areas, Vancouver Island, by C. H. Clapp, 445 pp., 12 pls., 2 figs., 6 maps Nos. 1191 (41A), 1192 (42A), 1193 (43A), 1194 (44A), 1567 (157A), 1654 (167A).

CANADIAN PACIFIC RAILWAY EXPLORATORY SURVEY REPORTS:

Progress Report on the Canadian Pacific Railway Exploration Survey, by Sandford Fleming. 8vo, 80 pp., map and profiles. Ottawa, April 10th, 1872.

Note—This is the preliminary report on the exploratory surveys commenced in June, 1871. Respecting British Columbia, consult, "Report on Survey between New Westminster and Great Shuswap Lake," pp. 20-26; "Report on Exploration from Great Shuswap Lake to Howse Pass," pp. 27-38; and "Report on Exploration from Kootenay and Cariboo to Yellowhead Pass," pp. 39-49.

Report of Progress on the Explorations and Surveys up to Jan., 1874, by Sandford Fleming. 8vo, 286 pp., maps and profiles. Ottawa, 1874.

Note—This report contains a number of appendices treating of matters relating to British Columbia, such as reports upon the passes through the Coast, Cascade and Rocky mountains; on the North Bentinck Arm route; extracts from Sir Alexander Mackenzie's Journal and Vancouver's Account of Voyages; also upon the winter climate of the Rocky mountains. Consult pp. 3-5, 14-24, 105-155, 174-198, 215-256, 263-272.

Description of the Country between Lake Superior and the Pacific Ocean, on the Line of the Canadian Pacific Railway. 8vo, xi + 143 pp. Ottawa, November, 1876.

Note—This compilation was designed to furnish a concise description of the physical features of the country lying in Canada between the head of lake Superior and the Pacific ocean, through which country it was proposed to construct the Canadian Pacific railway. The information supplied is supported by extensive quotations from authorities (see pp. xxxi-xxxvi) and is intended to supplement the more technical reports of the Engineer For the 'British Columbia Section' see pp 65-88 ; and for reports by Marcus Smith see pp. 89-125 ; and for miscellaneous information, pp. 126-143.

Report on Surveys and Preliminary Operations on the Canadian Pacific Railway up to January,—1877—by Sandford Fleming. 8vo, xvi + 431 pp., maps and profiles. Ottawa, 1877.

Note—This report gives a concise résumé of the progress and results achieved during the six years of the survey. The Chief Engineer, commencing with the explorations and surveys in 1871, gives, under the general classification of 'Explorations,' 'Exploratory Surveys,' 'Revised Surveys,' 'Trial Locations,' 'Location Surveys' and 'Revised Locations,' a brief outline of the principal examinations made up to the close of 1876. For these six years, for British Columbia consult pp. 1-88a under the heading *In the Mountain Region.* The appendices pp. 89-111 contain much matter of interest relating to British Columbia such as elevations and list of stations established; exploration reports relating to the North Thompson river; the Similkameen and Tulameen valleys; inlets along the coast; winter conditions of inlets; economic minerals; notes on agriculture, stock raising, etc.; harbours, climate, etc. Consult Appendices A, C to K, Q to W, and Z.

Reports and Documents in Reference to the Location of the Line and a Western Terminal Harbour—1878—by Sandford Fleming. Maps. 8vo, 104 pp. Ottawa, 1878.

Note—This progress report deals with Canadian Pacific Railway exploratory and trial location surveys, especially in northern British Columbia For surveys from Yellowhead pass to Burrard inlet see pp. 30-77 ; from Port Simpson via the Skeena river to Fort George see pp 38-40 ; respecting surveys of various proposed routes see pp. 41-54 ; for report on location via the Thompson and Fraser rivers to Burrard inlet and to Bute inlet see pp. 55-61 ; also re terminal harbour and other matters see pp. 62 *et seq.*

Report in Reference to the Canadian Pacific Railway—1879—by Sandford Fleming. 8vo, 142 pp., map. Ottawa, 1879.

Note—This report contains relatively little information relating to British Columbia.

Report and Documents in Reference to the Canadian Pacific Railway—1880—by Sandford Fleming. Maps and plates. 8vo, xiii + 373 pp. Ottawa, 1880.

Note—This report of progress contains much valuable exploratory and other information. There are 24 items—comprising pages 31 to 350—in the Appendix of which Nos. 1 to 12 contain reports by engineers and others respecting more particularly the northern part of British Columbia and the Peace River District. For general report consult pp. 1-12 ; consult, especially, for general instructions respecting surveys, pp. 31-37 ; for exploration from Port Simpson via the Skeena river, lakes Babine and Stuart and the Peace River and Pine River passes to Lesser Slave lake, pp. 38-56 ; for explorations between Port Simpson, B.C., and Battleford, N.W.T., via Peace River valley, pp. 57-70 ; for trial location survey from Ware inlet up the Skeena river, pp. 71-74 ; for exploration through the northern portion of British Columbia in 1879, pp. 75-85 ; for memorandum regarding journey from Victoria, V.I., across northern British Columbia via the Peace River pass, pp 86-106 ; for report on the climate, agricultural value, geological features and economic minerals of the northern portion of British Columbia and of the Peace River country, pp. 107-131 ; for the agricultural capabilities of Vancouver island, pp. 132-138 ; for memorandum on Queen Charlotte islands, pp. 139-143 ; and for various notes respecting routes, harbours, meteorology, etc., consult pp. 144-168.

BRITISH COLUMBIA PROVINCIAL GOVERNMENT REPORTS:

MINISTER OF LANDS, ANNUAL REPORTS OF THE

Note—These include the Reports of the Forest, Water Rights and Survey Branches, which reports are also issued separately. The Report of the Water Rights Branch deals specifically with water matters. Casual references to water-power possibilities, however, are frequently found embodied in the reports of surveyors to the Survey Branch. Topographic descriptions are found in both the Forest and Survey Branch Reports. In this respect the Annual Reports of the Minister for 1912, 1913 and 1914 are specially noteworthy. Since the outbreak of the War the size of the volumes has been substantially reduced.

MINISTER OF MINES, ANNUAL REPORTS OF THE

Note—The reports from various mining districts, and the descriptions of mining activities, frequently contain references to water-power possibilities and, occasionally, give brief descriptions of certain developments. See, for example, the Report for 1910, pp. 43, 47, 52, 59, 75, 80, 81, 97, 108, 125, 141, 142, 147, etc.

COMMISSIONER OF FISHERIES, ANNUAL REPORTS OF THE

Note—References to the conditions of stream beds, to obstructions, to rapids or falls, etc., are frequently made in these reports. See, for example, the references in the Reports for 1913 and 1914 to the condition of the Fraser river due to the obstruction caused by the rock-slide which occurred during the construction of the Canadian Northern railway.

ROYAL GEOGRAPHICAL SOCIETY, LONDON, ENGLAND:

Note—The transactions of, and contributions to, this Society have been published in various forms as follows:

Journal of the Royal Geographical Society, London, 1831-80—50 vols.

Proceedings of the Royal Geographical Society, Vol. I, 1855, to Vol. XXII, 1878 ; then "New Series," Vol. I, 1879, to Vol. XIV, 1892. (From 1855 to 1880 both 'Journal' and 'Proceedings' were issued, the former containing the longer papers.)

Geographical Journal from Vol. I, 1893. Half-yearly. In progress.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY:

Douglas, Governor James. *Report of a Canoe Expedition along the East Coast of Vancouver Island, 1852.* Vol. XXIV, 1854, pp. 245-249, map.

Grant, Capt. W. Colquhoun. *Description of Vancouver Island, by its first Colonist.* Vol. XXVII, 1857. pp. 268-320, map.

Palliser, Capt. John. *Progress of the British North American Exploring Expedition under the Command of Capt. John Palliser.* Vol. XXX, 1860. pp. 267-314, map. [See also 'Proceedings' Royal Geographical Society, Vol. II, pp. 38 and 146, also Vol. III, p. 122.]

Grant, Capt. W. C. *Remarks on Vancouver Island, principally concerning Townsites and Native Population.* Vol. XXXI, 1861. pp. 208-213, map. [See also 'Proceedings,' Vol. I, pp. 487-490.]

Mayne, Lieut. Richard C. *Report on a Journey in British Columbia in the Districts Bordering on the Thompson, Fraser and Harrison Rivers.* Vol. XXXI, 1861. pp. 213-223.

Palmer, Lieut. H. Spencer. *Report on the Harrison and Lillooet Route, from the Junction of the Fraser and Harrison Rivers to the Junction of the Fraser and Kayosch Rivers, with Note on the Country Beyond, as far as Fount...* Vol. XXXI, 1861. pp. 224-236.

Begbie, Matthew B. *Journey into the Interior of British* ...*bia*. Vol. XXXI, 1861. pp. 237-248.

Downie, W. *Explorations in Jervis Inlet and Desolation Sound, British Columbia*. Vol. XXXI, 1861. pp. 249-256.

Mayne, Lieut. Richard C., of H.M.S. Plumper. *Sketch of the Country between Jervis Inlet and Port Pemberton, on the Lillooet River, a Branch of the Fraser River, British Columbia*. Vol. XXXI, 1861. pp. 297-302, map. *Note*—Respecting 1861, see also 'Proceedings,' Vol. IV, 1859, p. 33.

Mayne, Commr. Richard C., R.N. *Route in Exploring a Road from Albernie Canal to Nanaimo, in Vancouver Island, in May, 1861, with a Track Chart*. Vol. XXXII, 1862. pp. 529-535. [See also 'Proceedings,' Vol. VI, 1862, p. 107.]

Forbes, C. *Notes on the Physical Geography of Vancouver Island*. Vol. XXXIV, 1864. pp. 154-171, map. [See also 'Proceedings,' Vol. VIII, p. 83.]

Palmer, Lieut. H. S. *Remarks upon the Geography and Natural Capabilities of British Columbia, and the Condition of its Principal Gold Fields*. Vol. XXXIV, 1864. pp. 171-195, map. [See also 'Proceedings,' Vol. VIII, p. 87.]

Waddington, A. *On the Geography and Mountain Passes of British Columbia in Connection with an Overland Route*. Vol. XXXVIII, 1868. pp. 118-128, map. [See also 'Proceedings,' Vol. XII, p. 121.]

Brown, Robert. *On the Formation of Fjords, Canons, Benches, Prairies, and Intermittent Rivers*. Vol. XXXIX, 1869. pp. 121-131, map [of B.C. Coast]. [See also 'Proceedings,' Vol. XIII, p. 144.]

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY:

Palliser, Capt. John, and Dr. Hector. *On Practicable Passes through the Rocky Mountains within the British Possessions*. Vol. III, 1858. p. 122.

Palliser, Capt. John. *On the Rocky Mountains*. Vol. IV, 1859. pp. 73-76.

Torrens, Capt. R. W. *Journey to Fort Simpson, Queen Charlotte Islands*. Vol. IV, 1860. pp. 226-228. [Abstract of Journal is given.]

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Milton, Viscount, and Dr. Cheadle. *An Expedition across the Rocky Mountains into British Columbia, by the Yellow Head or Leather Pass*. Vol. IX, 1864. pp. 17-21.

Brown, Dr. Robert. *Explorations in the Interior of Vancouver Island*. Vol. IX, 1865. p. 305. [Notes.]

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Begbie, Matthew B. *On the 'Benches,' or Valley Terraces, of British Columbia*. Vol. XV, 1870. pp. 133-45.

Green, Rev. W. Spotswood. *Explorations in the Glacier Regions of the Selkirk Range, British Columbia*. Vol. XI (New Series), 1889. pp. 153-170, map.

Seton-Karr, H. W. *Explorations in Alaska and Northwest British Columbia*. Vol. XIII (New Series), 1891. pp. 65-86, map.

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GEOGRAPHICAL JOURNAL

Russell, Prof. Israel C. *The Glaciers of North America*. Vol. XII, No. 6, Dec., 1898. pp. 553-564.

Collie, Prof. Norman. *Explorations in the Canadian Rockies: A Search for Mount Hooker and Mount Brown*. Vol. XIII, No. 4, April, 1899. pp. 337-358, maps and illus. Consult also Vol. XVII, March, 1901, pp. 252-272; and *Further Explorations* . . ., Vol. XXI, May, 1903, pp. 485-502.

Cornish, Vaughan. *On Snow-Waves and Snow-Drifts in Canada, with Notes on the 'Snow-Mushrooms' of the Selkirk Mountains*. Vol. XX, No. 2, August, 1902. pp. 127-175, illus.

Klotz, Otto J. *Notes on Glaciers of South-Eastern Alaska and Adjoining Territory*. Vol. XIV, No. 5, Nov., 1899. pp. 523-534, map.

Coleman, Prof. A. P. *Mount Robson, the Highest Point in the Canadian Rockies*. Vol. XXXVI, No. 1, July, 1910. pp. 57-63.

Palmer, Howard. *Explorations about Mount Sir Sandford, British Columbia*. Vol. XXXVII, No. 2, F... ...911. pp. 170, map.

Longstaff, Dr. T. G. *Across the Purcell Range of British Columbia*. Vol. XXXVII, No. 6, June, 1911. pp. 589-600, map.

Wheeler, Arthur O. *Expedition to Spillimacheen Mountain, September, 1910*. Vol. XXXVII, No. 6, June, 1911 pp. 601-607, photo-topographical surveys.

Collie, J. Norman. *Exploration in the Rocky Mountains north of the Yellowhead Pass*. Vol. XXXIX, No. 3, Mar., 1912. pp. 223-235, map.

Palmer, Howard. *Observations on the Sir Sandford Glacier, 1911*. Vol. XXXIX, No. 5, May, 1912. pp. 446-453.

ROYAL COLONIAL INSTITUTE. Consult *Proceedings*.

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Dawson, Dr. G. M. *Mineral Wealth of British Columbia*. Vol. XXIV, 1893. pp. 238-264.

Rathbone, Edgar P. *The Gold Fields of Ontario and British Columbia*. Vol. XXIX, 1898. pp. 68-93.

Turner, Hon. J. H. *British Columbia of To-day*. Vol. XXXIII, 1902. pp. 110-131.

ROYAL SOCIETY OF CANADA. Consult *Proceedings and Transactions* of the. First Series, Vols. I-XII, years 1882-83 to 1894 (Index in Vol. XII); Second Series, Vols. I-XII, years 1895 to 1906; Third Series, Vols. I-XII, years 1907 to 1918.

Note—See also "Bibliography of the Members of the Royal Society of Canada," in Vol. XII, 1894.

Fleming, Sandford. *Expeditions to the Pacific*. Vol. VII, 1889, section 2. pp. 89-141.

Coleman, A. P. *Geography and Geology of the Big Bend of the Columbia*. Vol. VII, 1889, section 4. pp. 97-108.

Dawson, George M. *Physiographical Geology of the Rocky Mountain Region of Canada*. Vol. VIII, 1890, section 4. pp. 3-74.

Dawson, George M. *Secular Climatic Changes in British Columbia*. Vol. II (Second series), 1896. Section 4. pp. 159-166.

White, James. *Place Names in the Rocky Mountains Between the 49th Parallel and the Athabaska River*. Vol. X, (Third Series), 1916, section 2, p. 501-535.

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IV—TRAVEL AND EXPLORATION—MOUNTAINEERING AND OTHER SPORT

(Consult also under 'Topography,' section III, and 'History,' section V.)

ALPINE CLUB OF CANADA. Consult *Canadian Alpine Journal*, Vol. I, 1907. In progress.

BAILLIE-GROHMAN, W. A. *Fifteen Years' Sport and Life in the Hunting Grounds of Western America and British Columbia.* Roy 8vo, 403 pp., maps and plates. London, 1900

BARNEBY, W. HENRY. *Life and Labour in the Far, Far West: being Notes of a Tour in the Western States, British Columbia, Manitoba and the North-West Territory.* 8vo, 432 pp., map. London, 1884.
Note—For British Columbia see Chapters V, VI and VII.

———*New Far West and the Old Far East: being Notes of a Tour in North America, Japan, China, Ceylon, etc.* 8vo, 316 pp., maps and illustrations. London, 1889
Note—For British Columbia see Chapters III, IV, V, VI and X.

BARRETT-LENNARD, CAPT. C. E. *Travels in British Columbia, with the Narrative of a Yacht Voyage round Vancouver Island.* 8vo, 307 pp. London, 1862.

BROWN, ROBERT. *Vancouver Island, Exploration. 1864.* Printed by authority of the Government. 8vo, 28 pp. Victoria, V.I.

BUREAU OF PROVINCIAL INFORMATION. See reference to publications in Section II above.

BURPEE, LAWRENCE J. *Among the Canadian Alps.* 8vo, 239 pp., maps and illus. New York and Toronto, 1914.
Note—Includes good illustrations of Emperor Falls, Grand Fork river; and Twin Falls, Yoho valley.

BUTLER, CAPT. W. F. *The Wild North Land: being the Story of a Winter Journey, with Dogs, across Northern North America.* 8vo, 358 pp., with a route map and plates. London, 1874.
Note—For British Columbia see Chapters XX to XXVII.

CANADIAN ARCHIVES PUBLICATION No. 4. *Journal of the Yukon 1847-48*, by Alexander Hunter Murray, edited with notes by L. J. Burpee. 8vo, 125 pp., map and illus. Ottawa, 1910.

CANADIAN PACIFIC RAILWAY EXPLORATION SURVEY REPORTS. See under 'Topography,' section III.

CHITTENDEN, NEWTON H. *Official Report of the Exploration of the Queen Charlotte Islands for the Government of British Columbia.* 8vo, 80 pp., illus. Victoria, 1884.

COLEMAN, A. P. *The Canadian Rockies, New and Old Trails.* 8vo, 379 pp., map and illus. London, 1911.

COX, ROSS. See under 'Historical Works,' in section V.

CUMBERLAND, STUART. *The Queen's Highway from Ocean to Ocean.* 8vo, 431 pp., maps and plates. London, 1887.

EMERSON, JOHN, of Wolsingham. *British Columbia and Vancouver Island. Voyages, Travels and Adventures.* Sm. 8vo, 154 pp. Durham (England), 1865.

FLEMING, SANDFORD. *England and Canada: a Summer Tour between Old and New Westminster, with Historical Notes.* 8vo, 449 pp., map. Montreal, 1884.

FOOTNER, HULBERT. *New Rivers of the North.* 8vo, 281 pp., photographs. New York, 1912.
Note—Describes Upper Fraser and Peace rivers and the falls on Hay river.

GEOLOGICAL SURVEY OF CANADA, EXPLORATIONS BY. See under 'Topography,' section III.

GORDON, D. M. *Mountain and Prairie, a Journey from Victoria to Winnipeg, via Peace River Pass.* 8vo, 310 pp., maps and plates. London, 1880.

GRANT, REV. GEO. M. (of Halifax, N.S.). *Ocean to Ocean. Sandford Fleming's Expedition through Canada in 1872.* 8vo, 371 pp., illus. London, 1873.
Note—For British Columbia see Chap. IX to end.

GREEN, WILLIAM S. *Among the Selkirk Glaciers, being an Account of a Rough Survey in the Rocky Mountain Regions of British Columbia.* 8vo, 251 pp., map and illus. London and New York, 1890.

HAWORTH, PAUL LELAND. *On the Headwaters of Peace River: a Narrative of a Thousand-mile Canoe Trip to a little-known Range of the Canadian Rockies.* 8vo, 295 pp., illus. New York, 1917.

HORETZKY, CHARLES. *Canada on the Pacific: being an Account of a Journey from Edmonton to the Pacific by the Peace River Valley; and of a Winter Voyage along the Western Coast of the Dominion; with Remarks on the Physical Features of the Pacific Railway Route and Notices of the Indian Tribes of British Columbia.* Sm. 8vo, 244 pp., map and plan. Montreal, 1874.

JENNINGS, W. T. *On Routes to the Yukon.* 8vo, 28 pp. Ottawa, 1898.

JOHNSON, R. BYRON. *Very Far West Indeed: a Few Rough Experiences on the North-West Pacific Coast.* Sm. 8vo, 280 pp. London, 1872.

KENNEDY, CAPT. W. R. *Sporting Adventures in the Pacific, whilst in Command of the 'Reindeer.'* 8vo, 303 pp., illus. London, 1876.
Note—Pages 188-207 relate to British Columbia and Vancouver Island.

KING, MAJOR W. ROSS. *The Sportsman and Naturalist in Canada, or Note on the National History of the Game, Game Birds, and Fish of that Country.* Sm. 4to, 334 pp., illus. London, 1866.

LEES, J. A., and CLUTTERBUCK, W. J. *B.C., 1887: a Ramble in British Columbia.* 8vo, 387 pp., map and illus. London and New York, 1888.

LORD, JOHN KEAST. *Naturalist in Vancouver Island and British Columbia.* 8vo, 2 vols.; Vol. I, 358 pp.; Vol II, 375 pp.; illus. London, 1866.

——— *At Home in the Wilderness: What to do there and how to do it.* Post 8vo, 323 pp., illus. London, 1867.
Note—3rd ed., 1876. Original edition by 'The Wanderer.'

McDONALD, ARCHIBALD. See under 'Historical Works,' in section V.

McNAUGHTON, MARGARET. *Overland to Cariboo: an Eventful Journey of Canadian Pioneers to the Gold Fields of British Columbia in 1862.* Sm. 8vo, 176 pp. Toronto, 1896.

MACKENZIE, ALEXANDER. See under 'Historical Works' in section V.

MAYNE, R. C. See under 'Historical Works' in section V.

MILTON, VISCOUNT, and CHEADLE, W. B. See under 'Historical Works' in section V.

MOBERLY, WALTER. *The Rocks and Rivers of British Columbia.* 8vo, 104 pp., map. London, 1885.

OGILVIE, WILLIAM *Early Days on the Yukon and the Story of its Gold Finds.* 8vo, 306 pp., illus. London, New York and Toronto, 1913.

OUTRAM, JAMES. *In the Heart of the Canadian Rockies.* 8vo, 466 pp., map and illus. New York an London, 1905.

PALLISER, CAPT. JOHN. *Papers Relative to the Exploration by Captain Palliser of that Portion of British North America which lies between the Northern Branch of the River Saskatchewan and the Frontier of the United States; and between the Red River and Rocky Mountains.* Presented to both Houses of Parliament by command of Her Majesty, June, 1859. Folio, 64 pp., maps. London, 1859.*

——— *Further Papers Relative to the Exploration by the Expedition under Captain Palliser of that portion of British North America which lies between the Northern Branch of the River Saskatchewan and the Frontier of the United States; and between the Red River and the Rocky Mountains, and thence to the Pacific Ocean.* Presented to both Houses of Parliament by command of Her Majesty, 1860. Folio, 75 pp., maps. London, 1860.*

——— *The Journals, Detailed Reports, and Observations Relative to the Exploration by Captain Palliser of that Portion of British North America, which, in Latitude, lies between the British Boundary Line and the Height of Land or Watershed of the Northern or Frozen Ocean, respectively, and in Longitude, between the Western Shore of Lake Superior and the Pacific Ocean, During the Years 1857, 1858, 1859, and 1860.* Presented to both Houses of Parliament by command of Her Majesty, 19th May, 1863. Folio, 325 pp., London 1860.*

PALMER, HOWARD. *Mountaineering and Exploration in the Selkirks: a Record of Pioneer Work Among the Canadian Alps, 1908-1912.* 8vo, 439 pp., maps and illus. New York and London, 1914.

PIKE, WARBURTON. *Through the Sub-Arctic Forest. A Record of a Canoe Journey from Fort Wrangel to the Pelly Lakes and Down the Yukon River to the Behring Sea.* 8vo, 295 pp., maps. London and New York, 1896.
Note—Stikine and Liard rivers are referred to.

POOLE, FRANCIS. See under 'Historical Works' in section V.

ROSS, ALEXANDER. See under 'Historical Works' in section V.

ROYAL GEOGRAPHICAL SOCIETY. See under 'Topography,' section III.

ST. JOHN, MOLYNEUX. *The Sea of Mountains: an Account of Lord Dufferin's Tour through British Columbia in 1876.* 8vo. 2 vols.; Vol. 1, 325 pp.; Vol. 2, 290 pp. London, 1877.

SETON-KARR, H. W. *Bear Hunting in the White Mountains, or Alaska and British Columbia Revisited.* 8vo, 156 pp., map and illus. London, 1891.

SIMPSON, SIR GEORGE. See under 'Historical Works' in section V.

SOUTHESK, EARL OF. *Saskatchewan and the Rocky Mountains, a Diary and Narrative of Travel, Sport and Adventure, during a Journey through the Hudson's Bay Company's Territories in 1859 and 1860.* 8vo, 448 pp., with two folding maps and other illustrations. Edinburgh, 1875.

SPROAT, GILBERT MALCOLM. *Scenes and Studies of Savage Life.* 8vo, 317 pp., view of Sproat lake, Vancouver Island. London, 1868.

STUTFIELD, HUGH E. M., and COLLIE, J. NORMAN. *Climbs and Exploration in the Canadian Rockies.* 8vo, 343 pp., maps and illus. London, 1903.

SYMONS, LIEUT. THOMAS W. *Report of an Examination of the Upper Columbia River and the Territory in its Vicinity in September and October, 1881, to Determine its Navigability, and Adaptability to Steamboat Transportation.* Made by Direction of the Commanding General of the Department of the Columbia. 47th Congress, 1st Session, Senate, Ex. Doc. No. 186. Illus. Lge. 8vo, 133 pp. + map in 25 sheets and index sheet. Washington, 1882

TALBOT, FREDERICK A. *The New Garden of Canada, By Pack Horse and Canoe through Undeveloped British Columbia.* 8vo, 308 pp., map and illus. London, New York, Toronto, 1911.
Note—Well describes territory adjacent to route of Grand Trunk Pacific Railway

——— *The Making of a Great Canadian Railway. The Story of the Search for and Discovery of the Route, and the Construction of the Nearly Completed Grand Trunk Pacific Railway from the Atlantic to the Pacific, with some of the Hardships and Stirring Adventures of its Constructors in Unexplored Country.* 8vo, 349 pp., map and illus. Toronto, 1912.

TOLMIE, WILLIAM FRASER. *Canadian Pacific Railway Routes.* Victoria, 1877.

TURNER-TURNER, J. *Three Years' Hunting and Trapping in America and the Great North-West.* 4to, 182 pp., map, illus.

——— *Life in the Backwoods, from Original Photographs.* [A book of photographs.]

WADDINGTON, ALFRED. *Sketch of the Proposed Line of Overland Railway through British North America.* Second edition, with corrections. 8vo, 29 pp. Ottawa, 1871.

WHEELER, A. O. *The Selkirk Range, British Columbia.* 8vo; Vol. I, 459 pp., illus.; Vol. II, maps, diagrams and plates. Department of the Interior, Ottawa, 1905.

WHYMPER, FREDERICK. *Travel and Adventure in the Territory of Alaska, formerly Russian America—now ceded to the United States—and in Various Other Parts of the North Pacific.* 8vo, 331 pp., maps, views, etc. London, 1868.

WILCOX, WALTER DWIGHT. *The Rockies of Canada.* A revised and enlarged edition of *Camping in the Canadian Rockies.* [London, 1896.] Lge. 8vo, 300 pp. New York and London, 1909.

YUKON TERRITORY, THE. The Narrative of W. H. Dall, Leader of the Expedition to Alaska in 1866-1868. The Narrative of an Exploration made in 1887 in the Yukon District by George M. Dawson, D.S., F.G.S. Extracts from the Report of an Exploration made in 1896-1897 by Wm. Ogilvie, D.L.S., F.R.G.S., introduction by F. Mortimer Trimmer, F.R.G.S., with map of the territory, fifty woodcuts and twenty-two full-page illustrations. 8vo, 438 pp. London, 1898.

* These are Imperial blue books relating to Canada; see also in Section V.

V—HISTORIES AND WORKS OF HISTORICAL INTEREST

Including North-West Coast Voyages, Hudson's Bay Company Affairs, International Waters, Boundaries, Treaties.*

(a) *GENERAL*

BANCROFT, HUBERT HOWE. *History of British Columbia, 1792-1887.* 8vo, 792 pp., map. San Francisco, 1890.
Note—Contains Bibliography and Lists of Authorities.

——— *History of the North-West Coast of America.* 8vo, 2 vols.: Vol. I, 1543-1800, 735 pp.; Vol. II, 1800-1846, 768 pp. San Francisco, 1884.

——— *History of Oregon.* 8vo, 2 vols.: Vol. I, 1834-1848, 789 pp.; Vol. II, 1848-1888, 808 pp. San Francisco, 1886 and 1888.

——— *History of Washington, Idaho, and Montana, 1845-1889.* 8vo, 836 pp. San Francisco, 1890.

BEGG, ALEXANDER. *History of British Columbia from its Earliest Discovery to the Present Time.* 8vo, 568 pp., map and illus. Toronto, 1894.

BEGG, ALEXANDER [not the same as author of B.C. History]. *History of the North-West.* 8vo, in 3 vols.: Vol. I, 515+xlvii pp.; Vol. II, 420+xcvi pp.; Vol. III, 492+xxvii pp. Toronto, 1894-1895.

BRYCE, REV. GEORGE. *Mackenzie, Selkirk, Simpson*; in *The Makers of Canada.* 8vo, 305 pp. Toronto, 1905.

CANADA AND ITS PROVINCES, a History of the Canadian People and Their Institutions by One Hundred Associates. General Editors: Adam Shortt and Arthur G. Doughty. Vol. 21, Pacific Province, 346 pp.; Vol. 22, Pacific Province, 660 pp.
Note—Consult also in Vol. 8, 'Boundary Disputes and Treaties,' by James White, pp. 751-958.

COATS, R. H., and GOSNELL, R. E. *Sir James Douglas*; in *The Makers of Canada.* 8vo, 369 pp. Toronto, 1908.

COUES, ELLIOTT. 'New Light on the Early History of the Greater North-west.' *The Manuscript Journals of Alexander Henry, Fur Trader of the Northwest Company, and of David Thompson, Official Geographer and Explorer of the same Company, 1799-1814. Exploration and Adventure among the Indians on the Red, Saskatchewan, Missouri and Columbia Rivers.* 8vo, 3 vols.: Vol. I, xxviii+446 pp., portrait; Vol. II, 447-916 pp.; Vol. III, Index, 917-1,027 pp., maps. New York, 1897.

COX, ROSS. *The Columbia River; or Scenes and Adventures during a Residence of Six Years on the Western Side of the Rocky Mountains among Various Tribes of Indians Hitherto Unknown; Together with a Journey across the American Continent.* In two vols.: Vol. I, 333 pp.; Vol. II, 350 pp. 8vo. London, 1832.

HAZLITT, WILLIAM CAREW. *British Columbia and Vancouver Island: comprising a Historical Sketch of the British Settlements in the North-West Coast of America; and a Survey of the Physical Character, Capabilities, Climate, Topography, Natural History, Geology and Ethnology of that Region.* Sm. 8vo, 247 pp., map. London, 1858.

ILLUSTRATED BRITISH COLUMBIA. Pamphlet reprinted from *The West Shore* and comprising pages 267-306. 4to. Contains numerous early views. Victoria, 1884.

KERR, J. B. *Biographical Dictionary of Well Known British Columbians, with a Historical Sketch.* 8vo, 326 pp. Vancouver, 1890.

McCAIN, CHARLES W. *History of the S.S. 'Beaver.'* 12mo, 99 pp., illus. Vancouver, 1894.

McCONNELL, W. J. *Early History of Idaho.* 8vo, 420 pp., Caldwell, Idaho, 1913.

MACDONALD, DUNCAN GEORGE FORBES. *British Columbia and Vancouver Island: comprising a Description of these Dependencies, their Physical Character, Climate, Capabilities, Population, Trade, Natural History, Geology, Ethnology, Gold Fields and Future Prospects, also an Account of the Manners and Customs of the Native Indians.* 8vo, 524 pp., map. London, 1862.

McDONALD, ARCHIBALD. *Peace River, a Canoe Voyage from Hudson's Bay to the Pacific by the late Sir George Simpson in 1828; Journal of the late Chief Factor, Archibald McDonald.* Edited, with notes, by Malcolm McLeod. 8vo, 119 pp., map. Ottawa, 1872.

MACKENZIE, ALEXANDER. *Voyages from Montreal on the River St. Lawrence through the Continent of North America to the Frozen and Pacific Oceans; In the Years 1789 and 1793. With a Preliminary Account of the Rise, Progress and Present State of the Fur Trade of that Country.* 4to, 412 pp., maps and illus. London, 1801.
Note—For British Columbia see 'Journal of a Second Voyage,' Chapters III to XIII.

MACFIE, MATTHEW. *Vancouver Island and British Columbia: their History, Resources and Prospects.* 8vo, 574 pp., maps and plates. London, 1865.

MASSON, L. R. *Les Bourgeois de la Compagnie du Nord-Ouest récits de voyages, lettres et rapports inédits relatifs au Nord-Ouest Canadien. Publiés avec une Esquisse Historique et des Annotations.* 2 vols., sm. 4to: Vol. I, 154+413 pp. and map; Vol. II, 499 pp. Quebec, 1889, 1890.
Note—Vol. I contains 'Mr. Simon Fraser, Journal of a Voyage from the Rocky Mountains to the Pacific Coast, 1808.'

MAYNE, COMMANDER R. C., R.N., F.R.G.S. *Four Years in British Columbia and Vancouver Island: an Account of their Forests, Rivers, Coasts, Gold Fields, and Resources for Colonisation.* 8vo, 468 pp., map and illus. London, 1862.

MEANY, EDMOND S. *History of the State of Washington.* 8vo, 406 pp., maps and illus. New York, 1909.

MILTON, VISCOUNT, and CHEADLE, W. B. *The North-West Passage by Land: Being the Narrative of an Expedition from the Atlantic to the Pacific, undertaken with the view of Exploring a Route across the Continent to British Columbia through British Territory by one of the Northern Passes in the Rocky Mountains.* 8vo, 394 pp., illus. London, 1865.

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* In this section are given only the chief works in which reference is made to British Columbia. Bibliographies relating more generally to the Pacific Coast, to the Search for a North-West Passage and to the operations of the Hudson's Bay Company will be found in the following works, to which fuller reference is made in this section: Bancroft—Histories; Morice—History; Canada and Its Provinces; Burpee—Search for the Western Sea; Scholefield—British Columbia from the Earliest Times to the Present; Tyrrell—David Thompson's Narrative; also, Smith—Check List re Pacific Northwest; Judson—Subject Index re Pacific Northwest and Alaska.

MORICE, REV. A. G., O.M.I. *The History of the Northern Interior of British Columbia (formerly New Caledonia), 1660 to 1880.* 8vo, 368 pp., map and illus. Toronto, 1904.

NICOLAY, REV. C. G. *The Oregon Territory: a Geographical and Physical Account of that Country and its Inhabitants with outlines of its History and Discovery.* 12mo, 226 pp. London, 1846.

PEMBERTON, J. DESPARD (Surveyor-General, V.I.). *Facts and Figures Relating to Vancouver Island and British Columbia, showing What to Expect and How to Get There.* 8vo, 171 pp., maps. London, 1860.

POOLE, FRANCIS. *Queen Charlotte Islands: a Narrative of Discovery and Adventure in the North Pacific.* 8vo, 347 pp. London, 1872.

RATTRAY, DR. ALEXANDER. *Vancouver Island and British Columbia, Where They Are; What They Are; and What They May Become. A Sketch of Their History, Topography, Climate, Resources, Capabilities, and Advantages, Especially as Colonies for Settlement.* 8vo, 182 pp., maps and illus. London, 1862.

ROBINSON, NOEL. *Blazing the Trail through the Rockies; the Story of Walter Moberly and His Share in the Making of Vancouver.* By Noel Robinson and the Old Man Himself. 8vo, 118 pp., illus. Printed by *News-Advertiser.* [Vancouver, n.d.]

ROSS, ALEXANDER. *Adventures of the First Settlers on the Oregon or Columbia River: being a Narrative of the Expedition fitted out by John Jacob Astor, to Establish the 'Pacific Fur Company'; with an Account of Some Indian Tribes on the Coast of the Pacific.* 8vo, 352 pp., London 1849.

——— *The Fur Hunters of the Far West: a Narrative of Adventure in the Oregon and Rocky Mountains.* 8vo, 2 vols.: Vol. I, 333 pp.; Vol. II, 262 pp., frontispiece. London, 1855.

SCHOLEFIELD, E. O. S. *British Columbia from the Earliest Times to the Present.* In 4 vols., 4to.: Vol. I, Historical, 688 pp.; Vol. II, Historical, 727 pp.; Vol. III, Biographical, 1,159 pp.; Vol. IV, Biographical, 1,208 pp.; illustrated. Vancouver, 1914.

Note—See 'List of Authorities.'

SIMPSON, SIR GEORGE. *Narrative of a Journey Round the World during the Years 1841 and 1842.* 8vo, 2 vols.: Vol. I, 438 pp., map; Vol. II, 469 pp., portrait and map of the author's route. London, 1847.

Note—For British Columbia see Vol. I, Chapters III, IV, V.

STEWART, ELIHU. *Down the Mackenzie and Up the Yukon in 1906.* 8vo, 270 pp., map and illus. London, 1913.

THOMPSON, DAVID. Consult items under Coues and Tyrrell, in this section.

TYRRELL, J. B. *David Thompson's Narrative of His Explorations in Western America, 1784-1812.* Published by the Champlain Society. 8vo, xcviii + 582 pp., maps and illus. Toronto, 1916.

WADE, MARK S. *The Thompson Country, being Notes on the History of Southern British Columbia, and Particularly of the City of Kamloops, formerly Fort Thompson.* 8vo, 136 pp. Kamloops, 1907.

WALBRAN, CAPTAIN JOHN T. *British Columbia Coast Names.* See above, under section I.

WALKEM, W. WYMOND, M.D. *Stories of Early British Columbia.* Lge. 8vo, 287 pp., illus. Vancouver, 1914.

WINSOR, JUSTIN. *Narrative and Critical History of America.* Lge. 8vo, 8 vols. Boston, 1884-1889.

(b) WORKS RELATING MORE PARTICULARLY TO NORTH-WEST COAST EXPLORATION

BAILLAIRGE, G. F. *Canada from the Atlantic to the Pacific and Arctic Oceans, Arctic Voyages, Voyages of Discovery in the North, and Public Works, etc., etc.* Being Appendices No. 22 and 23 to Annual Report of the Minister of Public Works, 1890. 8vo, 271 pp.

Note—Contains chronological list of voyages.

BARRINGTON, DAINES. *Miscellanies: by the Honourable Daines Barrington.....* 4to, iv + viii + 557 (1) pp., 2 maps and 4 tables. London, 1781.

Note—Contains pp. 469-534; *Journal of a voyage in 1775. To explore the coast of America, Northward of California, by the second Pilot of the Fleet, Don Francisco Antonio Maurelle, in the King's Schooner called the Sonora, and commanded by Don Juan Francisco de la Bodega.*

BROUGHTON, WILLIAM ROBERT.

Note—For the reason expressed in footnote on page 616, Broughton, *Voyage to the North Pacific Ocean,* is not listed; but it is pertinent here to record that the 'Log' of Lieutenant Broughton, who in the Armed Tender *Chatham,* accompanied Captain Vancouver with the *Discovery,* was obtained from the Public Records Office, London, Eng., by Mr. J. B. Tyrrell, and a copy communicated to Mr. T. C. Elliott, who has reproduced the "Log of H.M.S. Chatham"—accompanied by notes—in the *Quarterly of the Oregon Historical Society,* Vol. 18, No. 4, December, 1917, pages 231-243, with maps.

BURPEE, LAWRENCE J. *The Search for the Western Sea: the Story of the Exploration of North-Western America.* 8vo, lx + 651 pp., illus. and map. Toronto, [1908].

COOK, JAMES, and KING, JAMES. *A Voyage to the Pacific Ocean, Undertaken . . for making Discoveries in the Northern Hemisphere . . . performed . . . in H.M. Ships the 'Resolution' and 'Discovery' in the years 1776-1780.* 4to, 3 vols. [maps, charts and drawings.] London, 1784.

DIXON, CAPT. GEORGE. *Voyage Round the World; but more particularly to the North-West Coast of America: performed in 1785-88 in the 'King George' and 'Queen Charlotte,' Captains Portlock and Dixon.* In a series of letters, by W. B[eresford; edited and] dedicated by . . . G. Dixon. 4to. London, 1789.

ELLIS, W. *An Authentic Narrative of a Voyage Performed by Captain Cook and Captain Clerke in His Majesty's Ships 'Resolution' and 'Discovery' during the years 1776, 1777, 1778, 1779, and 1780, in Search of a North-West Passage between the Continents of Asia and America. Including a faithful Account of all their Discoveries and the Unfortunate Death of Captain Cook.* 8vo, 2 vols.: Vol. I, 358 pp.; Vol. II, 347 pp.; chart and cuts. London, 1782.

FRANCHÈRE, GABRIEL. *Relation d'un voyage à la côte du Nord-Ouest de l'Amérique Septentrionale, dans les années 1810, 11, 12, 13, et 14.* Par G. Franchère, fils. 8vo, 284 pp. Montreal, 1820.

——— *Narrative of a Voyage to the Northwest Coast of America in the Years 1811, 1812, 1813, and 1814, or the First American Settlement on the Pacific,* by Gabriel Franchère. Translated and edited by J. V. Huntington. 8vo, 376 pp. New York [J. S. Redfield], 1854.

GREENHOW, ROBERT. See below under sub-section (*d*).

JUDSON, KATHARINE B. *Subject Index to the History of the Pacific Northwest and of Alaska. As found in the United States Government Documents, Congressional Series, in the American State Papers, and in other Documents, 1789-1881.* 8vo, 341 pp. Olympia, Wash., 1913.

LEDYARD, JOHN. *A Journal of Captain Cook's Last Voyage to the Pacific Ocean . . . and in Quest of a North-West Passage, . . . with a Chart . . . Faithfully Narrated from the Original MS. of J. L.* 8vo, Hartford, Connecticut, 1783.

——— *Memoirs of the Life and Travels of, from His Journals and Correspondence*, by Jared Sparks. 8vo. London, 1828.

Note—Ledyard accompanied Capt. Cook on his third voyage around the world.

MANNING, WILLIAM RAY. 'The Nootka Sound Controversy.' pp. 279-478 in *Annual Report of the American Historical Association for the Year 1904.* 8vo, 708 pp. Washington, 1905.

Note—For bibliography giving the sources of information respecting the Nootka Sound controversy in the order of their importance, see pp. 472-478.

MARCHAND, ETIENNE. *Voyage Autour du Monde Pendant Les Années 1790, 1791, et 1792. Par Etienne Marchand; Précédé d'une Introduction Historique; Auquel on a Joint Des Recherches Sur les Terres Australes de Drake, et un Examen Critique du Voyage de Roggeween*; avec Cartes et Figures: Par C. P. Claret de Fleurieu, De l'Institut National des Sciences et des Arts, et du Bureau des Longitudes. 4to, 4 vols. Paris, 1798-1800, An. VI—VIII, De l'Imprimerie de La Republique, An. VIII.

English Edition: *A Voyage Round the World, Performed during the Years 1790, 1791, and 1792, Preceded by a Historical Introduction*, and Illustrated by charts, etc. Translated from the French of C. P. Claret de Fleurieu. 8vo, 2 vols.: Vol. I, 536 pp.; Vol. II, 663 pp. + 105 pp. London, 1801.

MEARES, COMMR. JOHN. *Voyages Made in the Years 1788 and 1789 from China to the North-West Coast of America. To which are prefixed: An Introductory Narrative of a Voyage Performed in 1786, from Bengal, in the Ship "Nootka"; Observations on the Probable Existence of a North-West Passage; and Some Account of the Trade Between the North West Coast of America and China; and the Latter Country and Great Britain.* Roy. 4to, 372 pp. and appendices, portrait, plates and maps. London, 1790.

MEANY, EDMOND S. *Vancouver's Discovery of Puget Sound. Portraits and Biographies of the Men Honoured in the Naming of Geographic Features of Northwestern America.* 8vo, 344 pp., maps and illus. New York and London, 1907.

NEWCOMBE, C. F. *The First Circumnavigation of Vancouver Island.* Being *Memoir No. 1*, Provincial Archives Department. 8vo, 69 pp., map. Victoria, 1914.

PORTLOCK, CAPTAIN NATHANIEL. *A Voyage Round the Word; but More Particularly to the North-West Coast of America: Performed in 1785, 1786, 1787 and 1788, in the 'King George' and 'Queen Charlotte,' Captains Portlock and Dixon.* 4to, 384 + xl pp., portrait, maps and plates. London, 1789.

SMITH, CHARLES W. *Check-List of Books and Pamphlets relating to the History of the Pacific Northwest.* 8vo, 191 pp. Olympia, Wash., 1909.

(e) *HUDSON'S BAY COMPANY AND NORTH-WEST COMPANY*

BRYCE, REV. DR. GEORGE. *The Remarkable History of the Hudson's Bay Company, Including That of the French Traders of North-Western Canada and of the North-West, X.Y., and Astor Fur Companies.* 8vo, 501 pp., maps and illus. London, 1900.

FITZGERALD, JAMES EDWARD. *An Examination of the Charter and Proceedings of the Hudson's Bay Company, with Reference to the Grant of Vancouver's Island.* Sm. 8vo, 293 pp., map. London, 1849.

——— *Vancouver's Island, the Hudson's Bay Company and the Government.* 8vo, 30 pp. London, 1848.

Note—Reprinted from the *Colonial Magazine* for September, 1848.

HARMON, DANIEL WILLIAMS, a Partner in the North-West Company. *A Journal of Voyages and Travels in the Interior of North America, between the 47th and 58th degrees of North Latitude, extending from Montreal nearly to the Pacific Ocean, a distance of about 5,000 miles, including an account of the principal occurrences, during a residence of nineteen years, in different parts of the country. To which are added, a concise description of the face of the country, its inhabitants, their manners, customs, laws, religion, etc., and considerable specimens of the two languages most extensively spoken; together with an account of the principal animals to be found in the forests and prairies of this extensive region. Illustrated by a map of the country.* 8vo, 432 pp. Andover, 1820. [Edited by Daniel Hasket, who, apparently, took liberties with the original.]

HUDSON'S BAY COMPANY, REPORT FROM THE SELECT COMMITTEE ON THE; together with the Proceedings of the Committee, Minutes of Evidence, Appendix and Index. Ordered, by the House of Commons, to be printed, 31 July and 11 August, 1857. Folio, xviii + 547 pp., 2 maps (Arrowsmith). London, 1858.

IMPERIAL BLUE BOOKS RELATING TO CANADA. Many of these Blue Books contain important historical data relating to the early days of the colonies of Vancouver Island and British Columbia; to the operations of the Hudson's Bay and North-West companies; to boundaries and treaties; to legislation; to discoveries of gold and to exploration. Valuable maps are frequently included. The following are the chief of these reports:

Copies or Extracts of Correspondence Relative to the Discovery of Gold in the Fraser's River District, in British North America. Presented to both Houses of Parliament, July 2, 1858. Folio, 18 pp.

Papers Relative to the Affairs of British Columbia. Part I. Presented to both Houses of Parliament, 18 February, 1859. Folio, 83 pp., map.

Note—These Papers contain despatches from Governor Douglas to the Secretary of State and *vice versa*—relating to the government of the colony and make particular reference to the gold discoveries and routes to the Fraser River gold fields.

Papers Relative to the Affairs of British Columbia. Part II. Presented to both Houses of Parliament, 12th August, 1859. Folio, 93 pp., maps and charts.

Note—Contains despatches dealing with a variety of matters relating to the early government of the colony and special references to the gold fields.

Further Papers Relative to the Affairs of British Columbia. Part III. Presented to both Houses of Parliament, 1860. Folio, 110 pp., map. London, 1860.

Note—Contains despatches as above and includes reports on exploratory surveys by Begbie, Mayne, Palmer, Downie, Ball.

Further Papers Relative to the Affairs of British Columbia. Part IV. Presented to both Houses of Parliament, March, 1862. Folio, 80 pp., 4 maps. London, 1862.

Note—Contains despatches as above, also copies of certain Proclamations having the force of law.

NOTE—The above and the Palliser papers, listed in Section IV, are the more important Imperial Blue Books relating to British Columbia. There are, however, many others, such for example as Paper No. 619 of 1848 (17 pp.), dealing with Vancouver Island Colonization; Papers Nos. 788 (15 pp.) and 788 I (12 pp.) of 1853, dealing with Gold on Queen Charlotte Islands; Papers Nos. 438 (21 pp.) of 1863 and 402 (16 pp.) of 1864, dealing with Road and Telegraph to Canada; Papers Nos. 3667 (4 pp.) and 3694 (2 pp.) of 1866 and 3852 (47 pp.) of 1867 dealing with the Union of Vancouver Island and British Columbia; also Paper No. 390 (31 pp.) of 1869, relating to Confederation. There are also papers relating to the protracted negotiations and treaties respecting the Oregon Territory (1846) and the North-West American Water Boundary Question (1873), etc., etc. Copies of these papers are usually to be found in the chief reference libraries.

MACKENZIE, ALEXANDER. See 'History of the Fur Trade,' in *Voyages, etc.* See above in this section.

M'LEAN, JOHN. *Notes of a Twenty-five years' Service in the Hudson's Bay Territory.* 8vo, 2 vols.: Vol. I, 308 pp.; Vol. II, 328 pp. London, 1849.

MARTIN, R. M. *The Hudson's Bay Territories and Vancouver's Island, with an Exposition of the Chartered Rights, Conduct and Policy of the Honourable Hudson's Bay Corporation.* 8vo, viii + 175 pp., map. London, 1849.

MARTIN, ARCHER. *The Hudson's Bay Company's Land Tenures and the Occupation of Assiniboia by Lord Selkirk's Settlers, with a List of Grantees under the Earl and the Company.* 8vo, 238 pp., maps. London, 1898.

PUGET'S SOUND AGRICULTURAL COMPANY. British and American Joint Commission for the final settlement of the claims of the Hudson's Bay and Puget's Sound Agricultural Companies.

Note—See the 'Papers' containing the Memorials, Evidence, Arguments, etc., p[illegible]nted to the Commissioners by the Hudson's Bay Company and the Puget's Sound Agricultural Comp[illegible]lso, in behalf of the United States, the Evidence, Arguments, etc.; and the Award of the Commissioners [illegible] pronounced [illegible] Sept., 1869. These Papers consist of 14 parts: Montreal, parts, 2-7, 1868-1869; Washington, parts 1 [illegible] 1865-1868.

[illegible], also: Transcripts of papers relating to the affairs of the Company; prospectus; list of share-[illegible]andum relating to the Cowlitz farm, by A. C. Anderson (1841, 3 pages); judgment of [illegible] Washington Territory in the case of Puget's Sound Agric. Co. *vs.* Pierce County (Jan. 17, 1862), [illegible] relating to Nesqually and Cowlitz claims; account of Frank Clarke with the Company (1865); origin of the Puget's Sound Agric. Co., by A. C. Anderson (1865); agreement between the Company and the U.S. (June 20, 1867); as referred to in "List of Authorities" in Scholefield's *British Columbia from the Earliest Times to the Present*, pp. XIX-XX.

TUTTLE, CHARLES R. *Our North Land: being a full account of the Canadian North-West and Hudson's Bay Route, together with a Narrative of the Experiences of the Hudson's Bay Expedition of 1884, including a Description of the Climate, Resources, and the Characteristics of the Native Inhabitants between the 50th Parallel and the Arctic Circle.* 8vo, 589 pp., maps and illus. Toronto, 1885.

Note—For Northern British Columbia see Chapter XXXIII.

(d) *INTERNATIONAL WATERS, BOUNDARIES, TREATIES*

INTERNATIONAL WATERWAYS COMMISSION—

Note—Respecting the organization and work of this Commission, consult *Water Powers of Canada*, Commission of Conservation, Ottawa, pp. 58 *et seq.*, and *Ibid* under *Bibliography*. See 'Reports by the International Waterways Commission,' pp. 367-368; also *Compiled Reports of the International Waterways Commission, 1905-1913.* 8vo, 1,224 pp., Ottawa, 1913.

INTERNATIONAL JOINT COMMISSION.

Note—For history of circumstances leading up to the formation of the International Joint Commission, consult *Water Powers of Canada*, Commission of Conservation, Ottawa, pp. 58 *et seq.* For copy of Treaty and Rules of Procedure, see *Rules of Procedure of the International Joint Commission*, Ottawa and Washington. The Boundary Waters Treaty is also found as Appendix No. 1 in *Water Powers of Canada*, Commission of Conservation, Ottawa, 1911. For list of reports and decisions of the Commission, consult *List of Decisions, Reports, etc., of the International Joint Commission*, Washington and Ottawa. The Commission maintains an office in Ottawa, Canada, and also one in Washington, D.C.

BALCH, THOMAS WILLING. *The Alasko-Canadian Frontier.* 8vo, 45 pp., maps. Philadelphia, 1902.

———— *The Alaska Frontier.* 8vo, 198 pp., maps. Philadelphia, 1903.

COWAN, GEORGE H. *British Columbia's Claim upon the Dominion Government for Better Terms.* 8vo, 31 pp., Vancouver, 1904.

CUSHING, CALEB. *The Treaty of Washington, its Negotiation, Execution, and the Discussion Relating Thereto.* 8vo, 280 pp. New York, 1873.

DAVIDSON, GEORGE. *The Alaska Boundary.* 8vo, 235 pp., maps. San Francisco, 1903.

FALCONER, T. *The Oregon Question: or, a Statement of the British Claims to the Oregon Territory, in Opposition to the Pretensions of the Government of the United States of America.* 2nd edition, 8vo, 50 pp. London, 1845.

GALLATIN, ALBERT. *The Oregon Question.* [Nos. 1-5, with Appendix.] 8vo, 78 pp. New York, 1846.

GREENHOW, ROBERT. *Memoir, Historical and Political, on the Northwest Coast of North America and the Adjacent Territories: illustrated by a Map and a Geographical View of those Countries.* 8vo, 228 pp. and map. New York, 1840. [Also published as Senate Document No. 174, 26th Congress, 1st Sess., Feb. 10, 1840. Washington, 1840.]*

———— *The History of Oregon and California, and the other Territories of the North-West Coast of North America, Accompanied by a Geographical View and Map of those Countries, and a Number of Documents as Proofs and Illustrations of the History.* 8vo, 1st edition, xviii + 482 pp., map, London, 1844. 2nd edition, xviii + 492 + 7 pp., Boston, 1845.*

NORTH-WEST BOUNDARY. *Discussion of the Water Boundary Question: Geographical Memoir of the Islands in Dispute: and History of the Military Occupation of San Juan Island.* 8vo, 270 pp., map and cross-sections of channel. Washington, D.C., 1868.

MILTON, VISCOUNT. *A History of the San Juan Boundary Question, as Affecting the Division of Territory between Great Britain and the United States.* 8vo, 446 pp., 2 maps. London, 1869.

*Greenhow's works were *ex parte* productions and, in view of numerous inaccuracies of statement contained in them, should be used with caution.

SAINT-CYR, ARTHUR. *Appendix No. 23, to Report of Surveyor-General* for the year 1900-01, pp. 76-84, *re* Survey of a Part of the Boundary Line between British Columbia and Yukon Territory, Dominion *Sessional Paper* No. 25. 8vo, maps and illustrations. Ottawa.

——— *Appendix No. 26, to Report of Surveyor-General* for the year 1901-02, pp. 84-95, *re* Survey of a Part of Boundary Line between British Columbia and Yukon Territory. Dominion *Sessional Paper* No. 25. 8vo, maps and illustrations. Ottawa.

TWISS, TRAVERS, D.C.L., F.R.S. *The Oregon Question examined, in respect to Facts and the Law of Nations.* 8vo, xi + 391 pp. London, 1846.

WHITE-FRASER, GEO. *Appendix No. 22 to Report of Surveyor-General,* for the year 1900-01, pp. 68-75, *re* Latitude Determination on the Boundary between the Province of British Columbia and the Yukon Territory. *Dominion Sessional Paper No. 25.* 8vo, map and illus.

WHITE, JAMES. See above under *Canada and its Provinces* in sub-section (a).

ERRATA

On page 10, line 38, for 'new fertile acres' read *now fertile areas.*

On page 36, at end of footnote, add—*Ninth Annual Report, 1918, pp. 73 to 95.*

On page 94, line 14 *et seq* should read: The minister may *or may not* make an order, etc.

On page 138, Mount Olie Plant, for 'Nakalliston' read *Nehalliston*. Spelling varies. In *Gazetteer of British Columbia* is given Nekalliston.

On plate 21. In title to bottom illustration, for 'Coteau' read *Couteau.*

On page 243, last paragraph, for 'Bear' river read *Bowron* river (its new name).

On plate 33. In title to upper illustration, for 'Zyometz' read *Zymoetz.*

On page 608, Publication number of *Summary Report* for the Calendar Year 1907 is *1017.*

INDEX

Note—Unless otherwise stated, municipalities, rivers, creeks, etc., listed in this Index are in the Province of British Columbia.

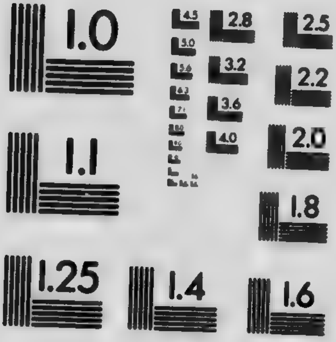
Precipitation Stations

IN

British Columbia

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



CASSIAR MOUNTAINS
COAST
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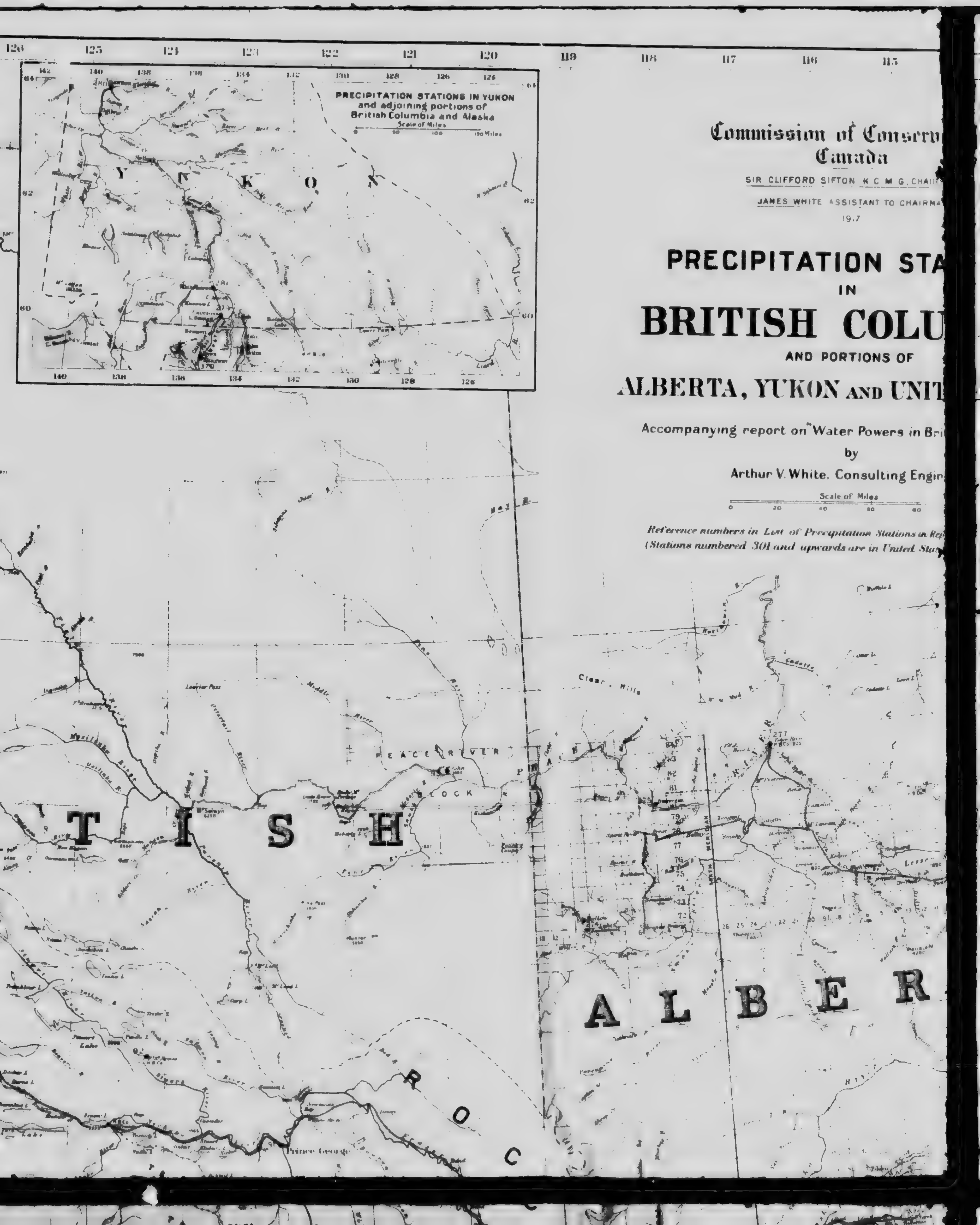
Atlin
Admiralty Island
Frederick Sound
Sitka
Baranof Island
Kupreanof Island
Telegraph Creek
PRINCE OF WALES ISLANDS
Revillagigedo I.
DIXON ENTRANCE
Prince Rupert
Hazelton
BABINE RANGE
GRAHAM I.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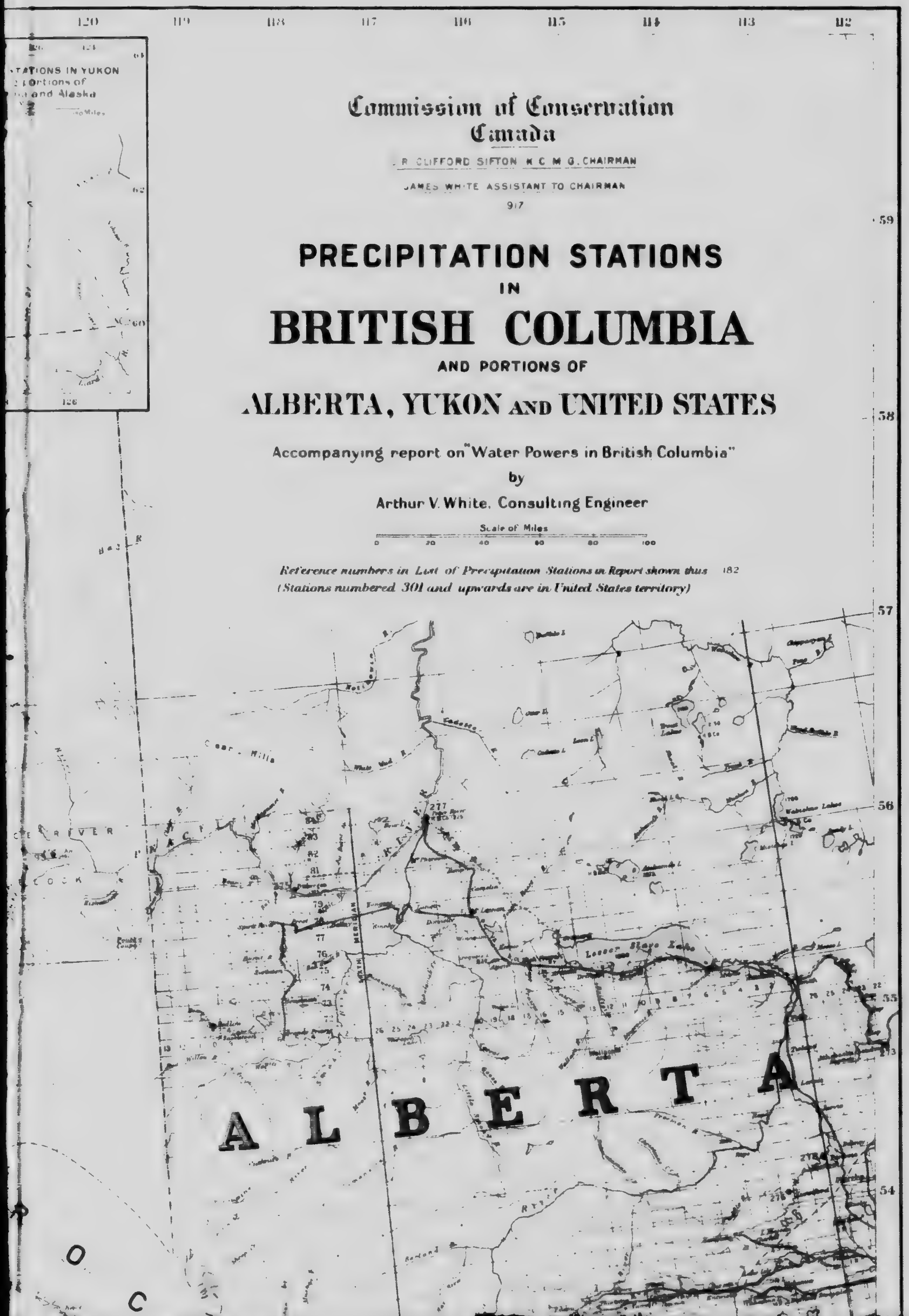

STATIONS IN YUKON
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and Alaska
Commission of Conservation
Canada
CLIFFORD SIFTON K C M G. CHAIRMAN
JAMES WHITE ASSISTANT TO CHAIRMAN
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PRECIPITATION STATIONS
IN
BRITISH COLUMBIA
AND PORTIONS OF
ALBERTA, YUKON AND UNITED STATES
Accompanying report on "Water Powers in British Columbia"
by
Arthur V. White, Consulting Engineer
Scale of Miles
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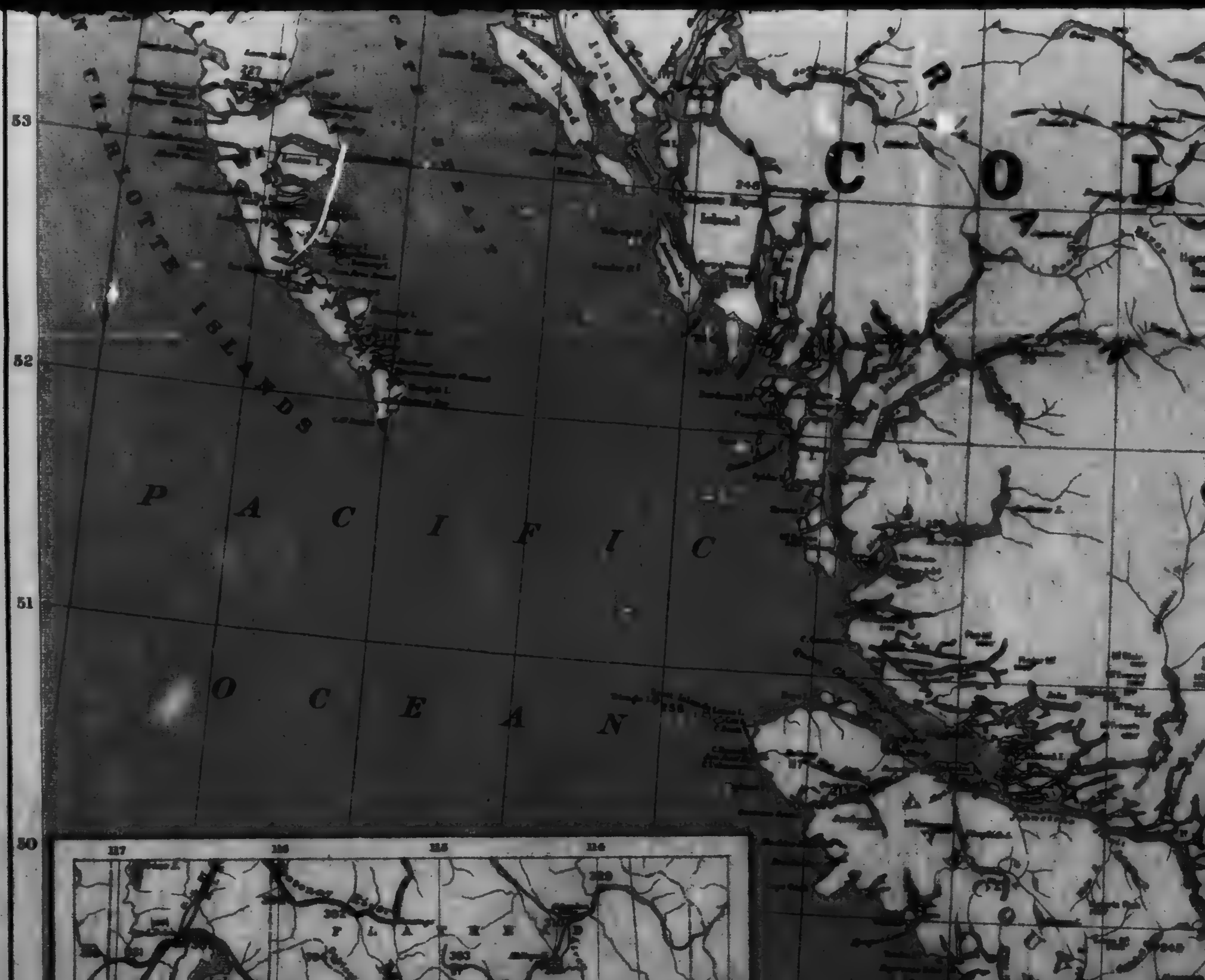
(Stations numbered 301 and upwards are in United States territory)
Lesser Slave Lake
ALBERTA



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C O L
PRECIPITATION STATIONS
IN
IDAHO AND WESTERN MONTANA
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L U M B I A
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VICTORIA
WHATCOM
SKAGIT
SNOHOMISH
JEFFERSON
FERRY
STEVENS
LINCOLN
SPOKANE
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H I N G T O N
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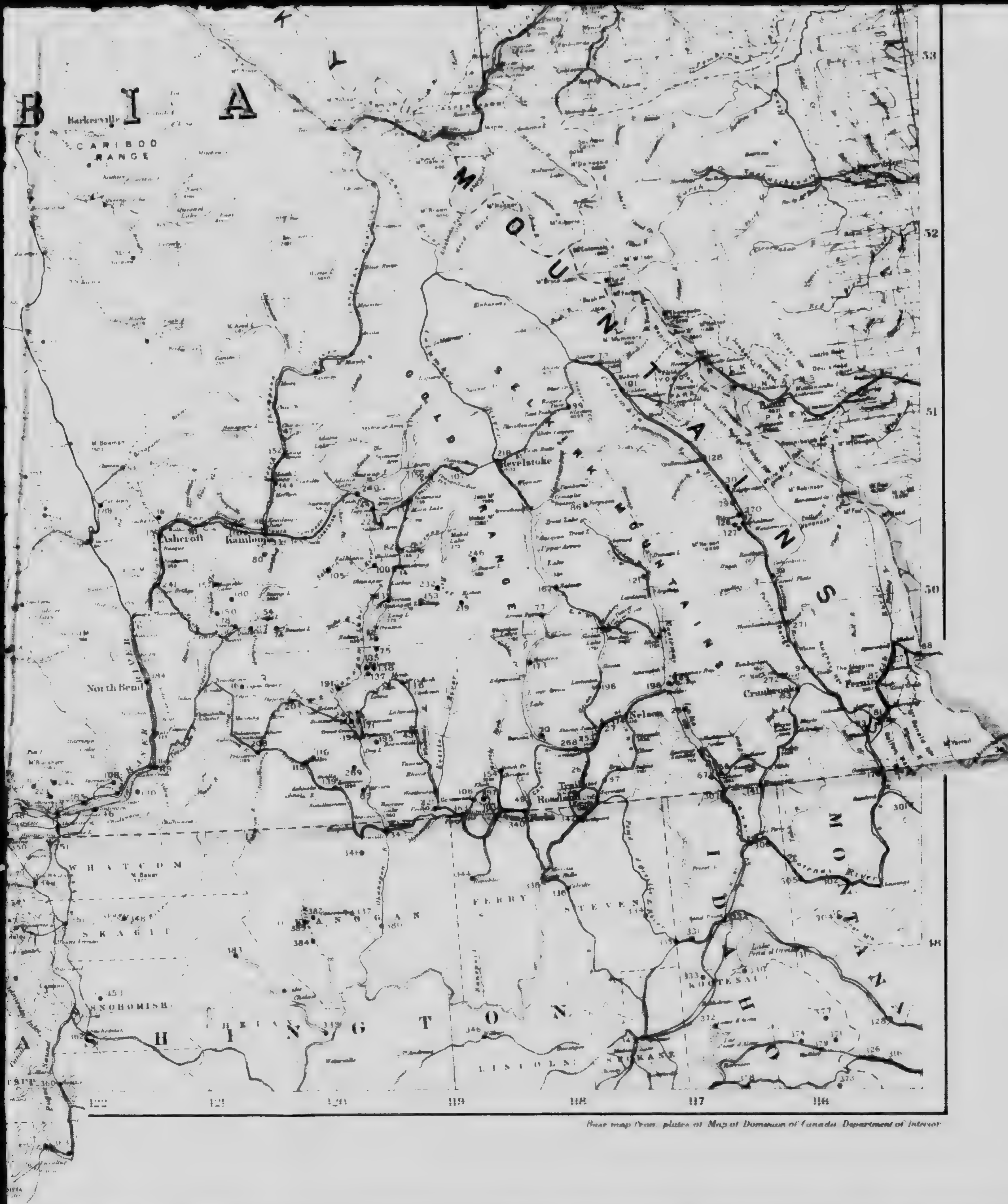
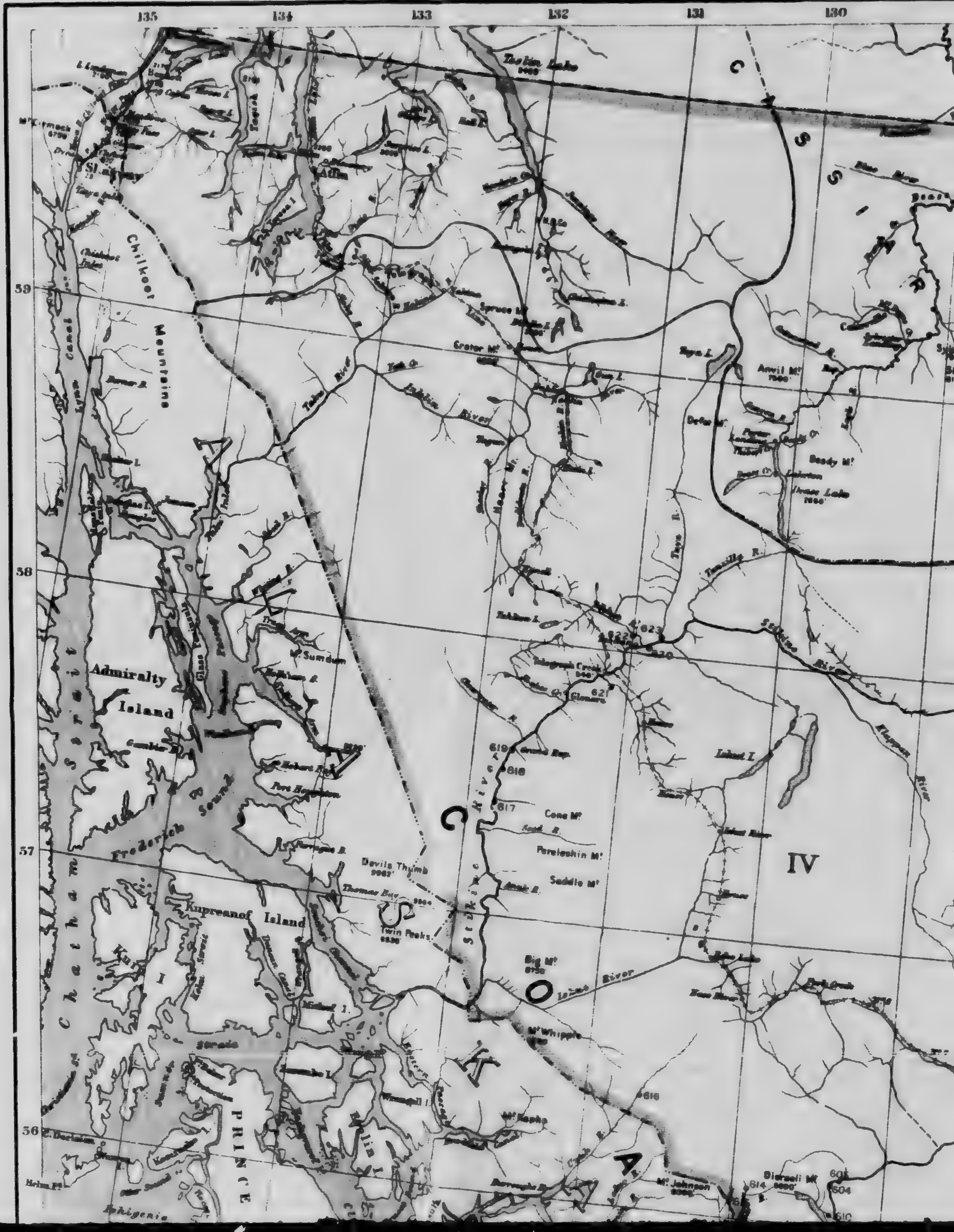
Base map from plate.



Base map from plates of Map of Dominion of Canada, Department of Interior

Water-Powers
OF
British Columbia



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Teslin Lake
Atlin
Chilkoot
Mountains
Lynn Canal
Admiralty
Island
Frederick Sound
Chatham Strait
Kupreanof Island
Mt Sumdum
Port Houghton
Thomas Bay
Devils Thumb
9067'
Twin Peaks
Crater Mt
Spruce Mt
Taku River
Nakina River
Anvil Mt
Beady Mt
Dease Lake
Tanzilla R.
Stikine River
Telegraph Creek
Glenora
Cone Mt
Pereleshin Mt
Saddle Mt
Big Mt
Iskut River
Mt Whipple
IV
Mt Johnson
Disraeli Mt
C. Decision
PRINCE

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Ft Liard
Black River
Fort Nelson River
Ft Nelson
Muskwa River
Prophet R.
Mt Reid
Fishing L.
Mt Prudence
Muncho L.
Toad R.
Sylvester Peak
Sheep Mt
Turnagain
Kechika
Sifton Pass
ROCKY MOUNTAINS
V
Fishing L.
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Thutade L.
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Ingenika
Laurier Pass
Finlay River
Ospika R.
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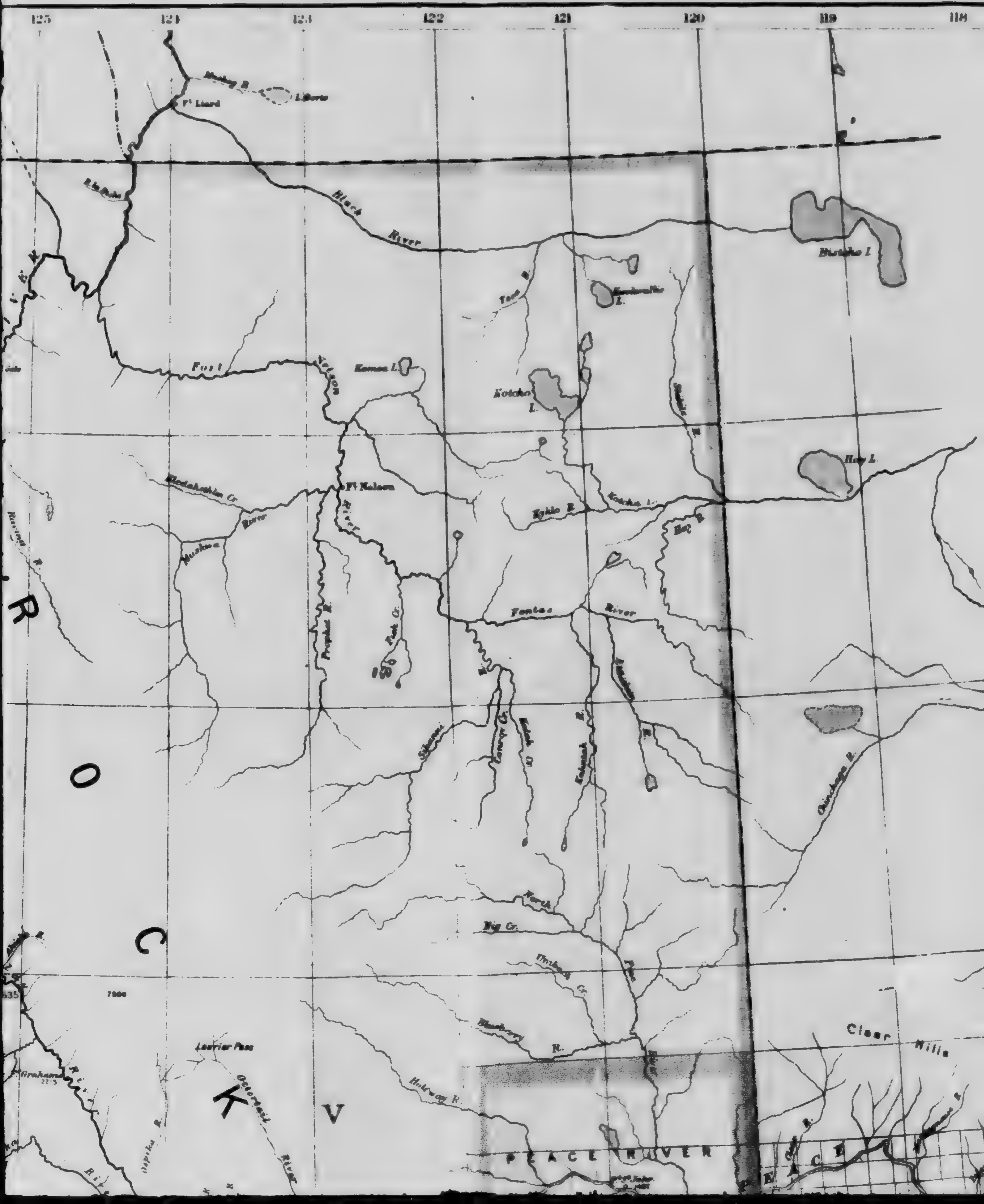

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Bistcho L.
Kotcho L.
Fort Nelson River
Ft Nelson
Kyklo R.
Kotcho L.
Hay L.
Hay R.
Fontas River
Prophet R.
Muskwa River
Sikanni
North
Big Cr.
Blueberry R.
Laurier Pass
Halfway R.
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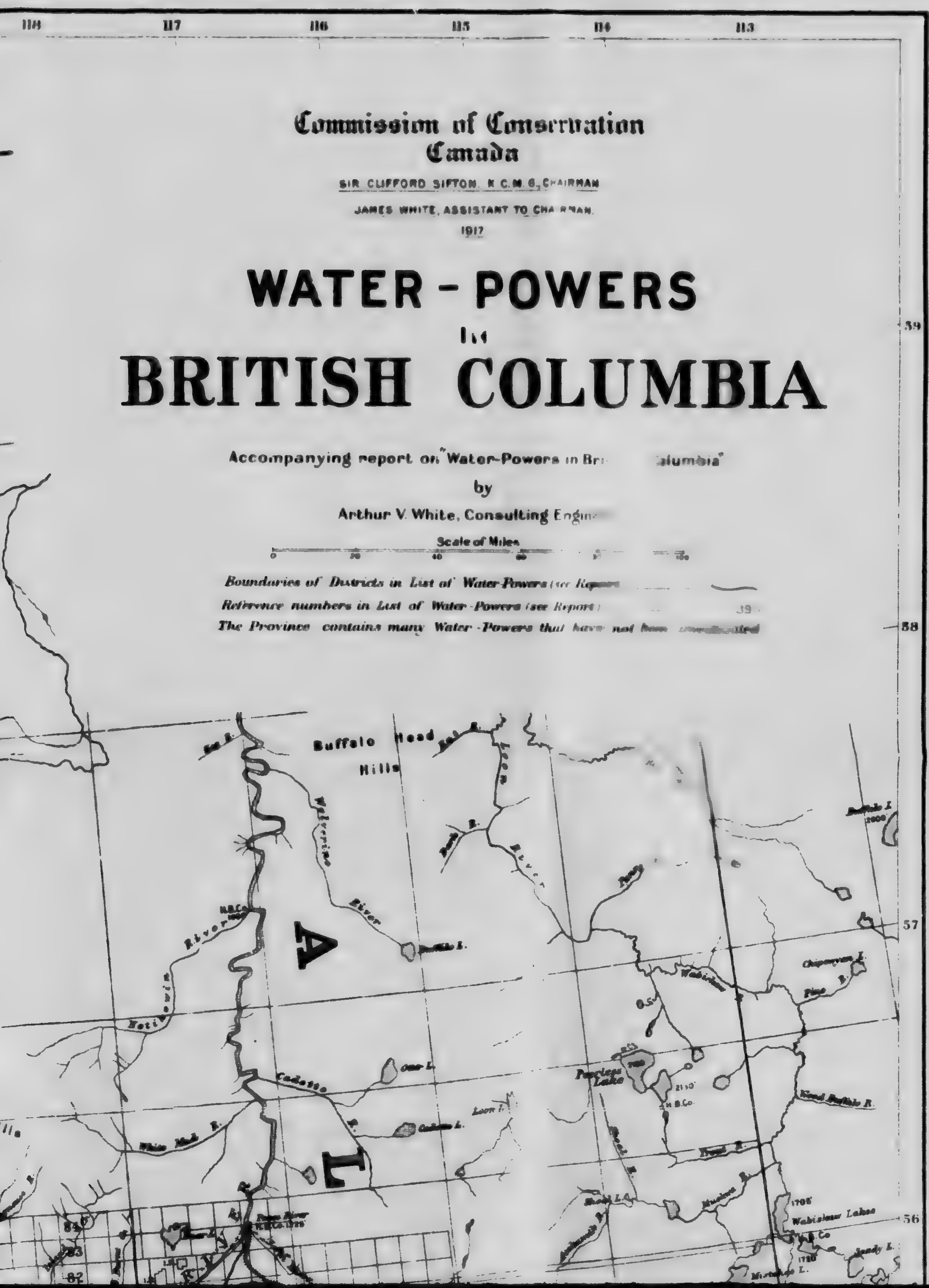
Clear Hills
PEACE RIVER


Commission of Conservation
Canada
SIR CLIFFORD SIFTON, K.C.M.G., CHAIRMAN
JAMES WHITE, ASSISTANT TO CHAIRMAN.
1917
WATER-POWERS
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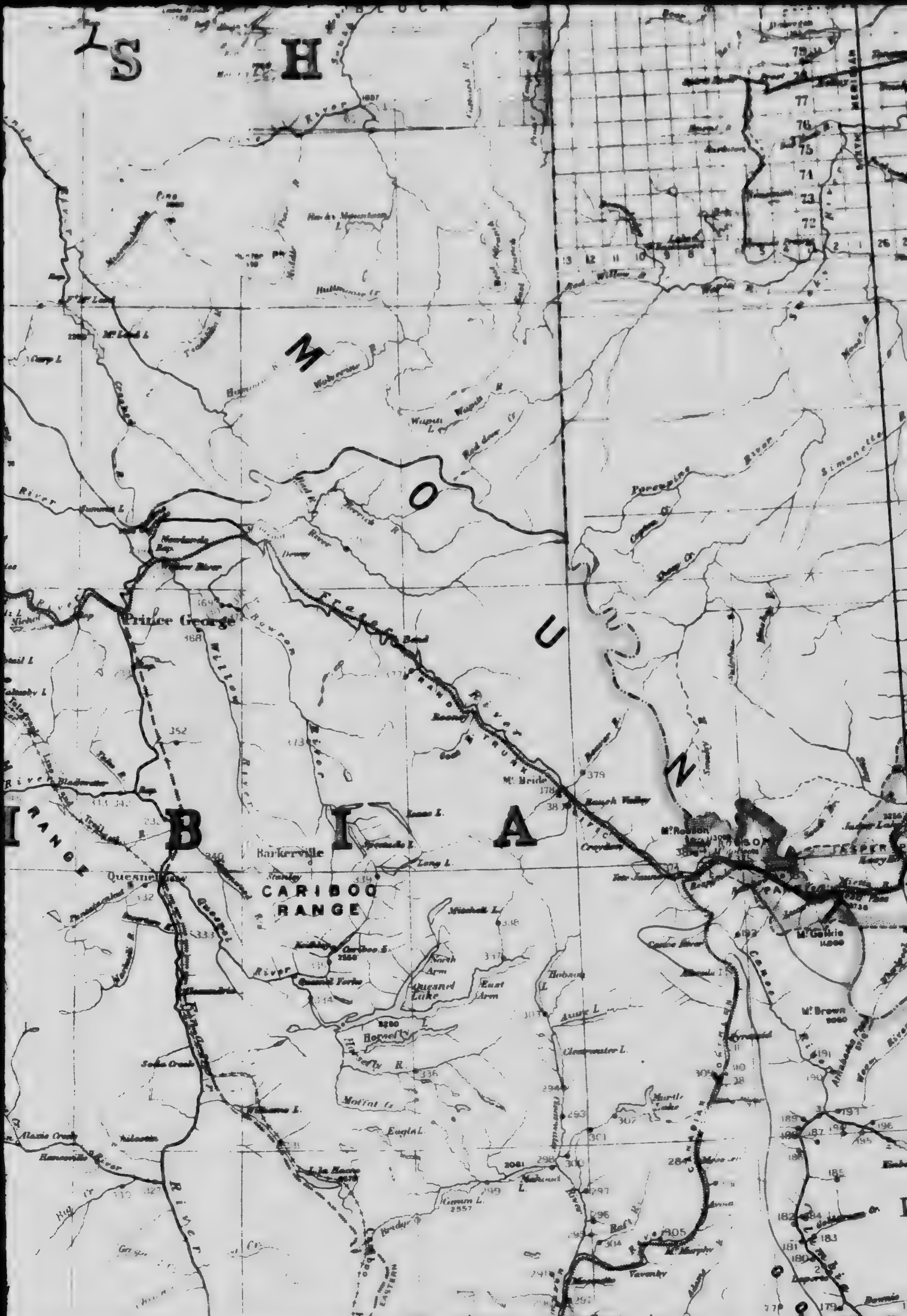
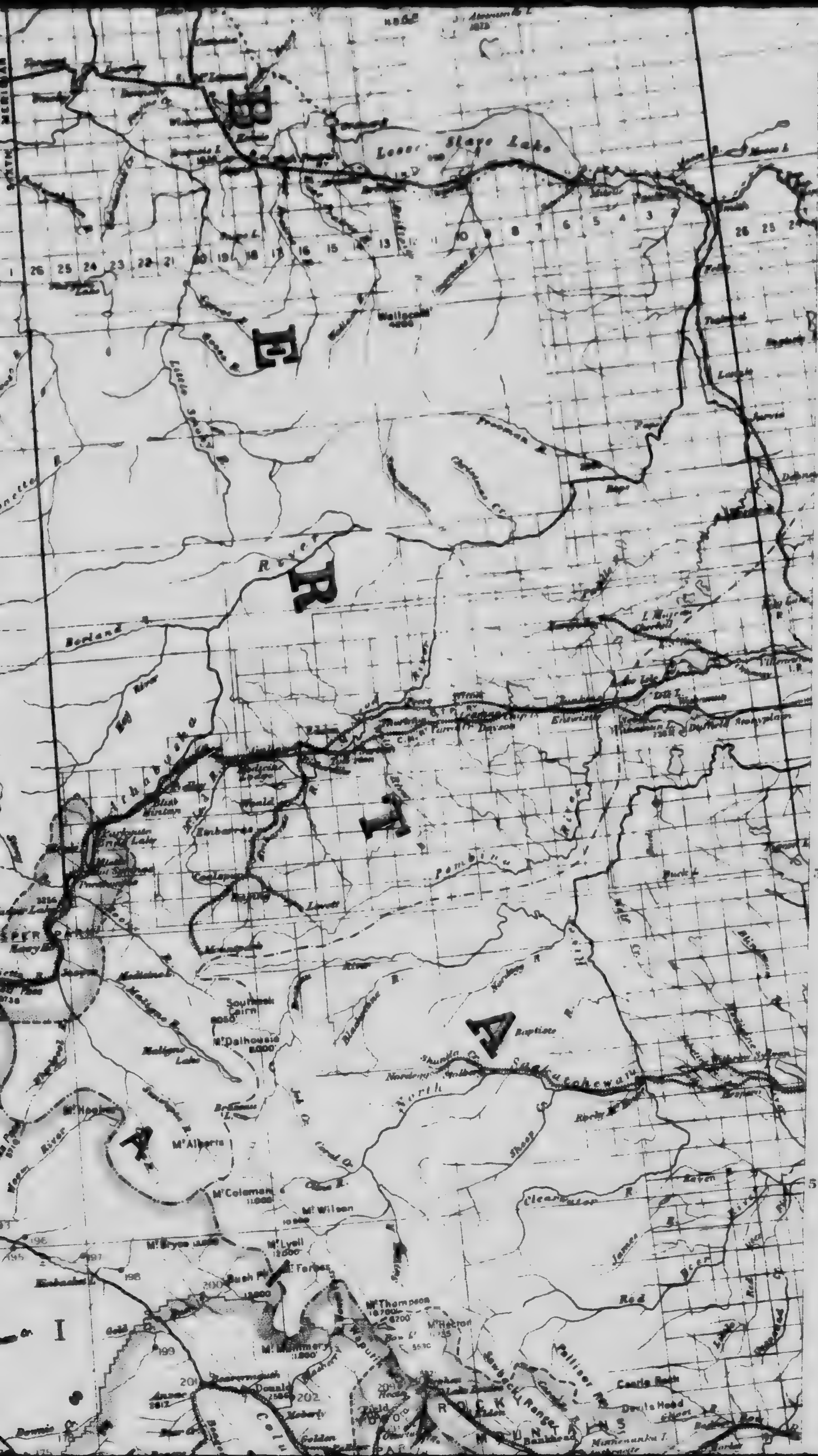
The Province contains many Water-Powers that have not been
Buffalo Head Hills
Wolverine River
A
L
Cadotte R.
Peerless Lake
Wabiskaw Lakes
Chipewyan L.
Loon L.
Sandy L.
118
117
116
115
114
113
59
58
57
56


OF WALES ISLAND
Revillagigedo I
DIXON ENTRANCE
QUEEN CHARLOTTE ISLANDS
GRAHAM I.
HECATE STRAIT
Prince Rupert
Banks Island
Pitt Island
Princess Royal Island
Louise I.
Frederick I.
Cape Ball
Hibben I.
Pacific
55
54
53
52

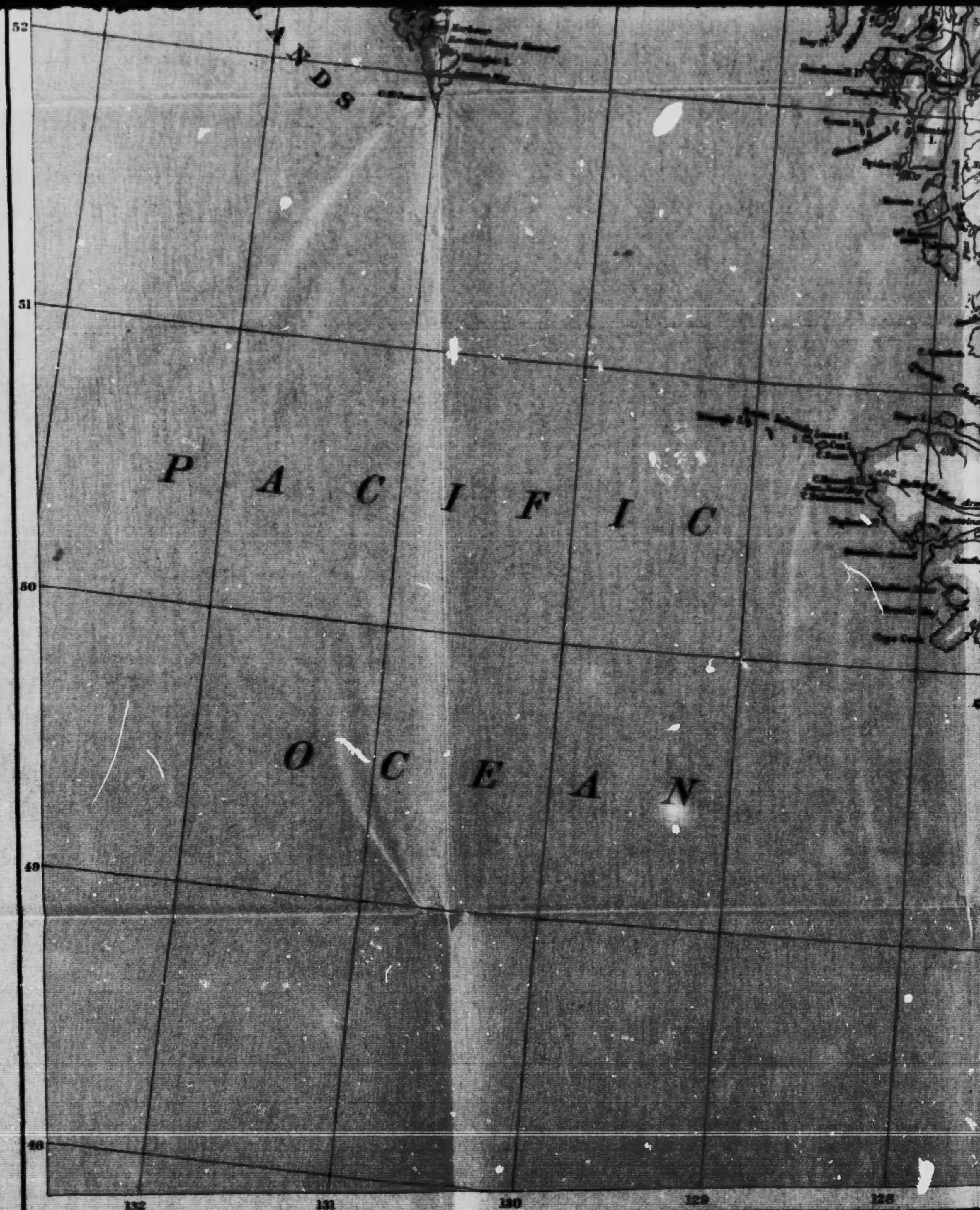
B R I T I S
C O L U M B
M O U N T
Hazelton
Smithers
Babine Range
Babine Lake
Takla Lake
Stuart Lake
Stuart River
Nation River
Salmon River
Endako
Fraser L.
Nechako River
Francois Lake
Ootsa Lake
Tahtsa L.
Eutsuk Lake
Natalkuz L.
Charlotte L.
Prince George
Telegraph Range
Blackwater River
Kuyakuz Mt 6000'
Fawnie Range
Ilgachuz Range 6000' to 7000
Itcha Mts 6000' to 7000
Plateau 3500
Quesnel
Chilcotin River
Island
Owikeno L.
IV
II



S
H
M
O
U
N
B
I
A
Prince George
Barkerville
CARIBOO
RANGE
RANGE
Quesnel
Quesnel Lake
Horsefly
Mt Bride
Croydon
Mt Robson
Mt Geikie
Mt Brown
Porcupine
Simonette
Long L.
Stanley
Clearwater L.
Moffat Cr.
Alexis Creek
Canoe River
Red Willow R.
Wapiti L.
Red deer Cr.
Fraser River
Wolverine R.
Bowron
Willow
River



Lesser Slave Lake
River
Borland R.
Athabaska
Pembina
North
Saskatchewan
Baptiste R.
Sheep Cr.
Clearwater R.
Raven
James
Red
Red Deer
Southesk Cairn
Mt. Dalhousie 8000
Maligne Lake
Mt. Alberta
Mt. Coleman 11000
Mt. Wilson
Mt. Lyell
Mt. Forbes
Mt. Thompson
Mt. Hector
Mt. Mummery
Donald
Field
Golden
Castle Rock
Devils Head
Palliser
ROCKY MOUNTAINS
I
55
54
53
52


P A C I F I C
O C E A N
52
51
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132
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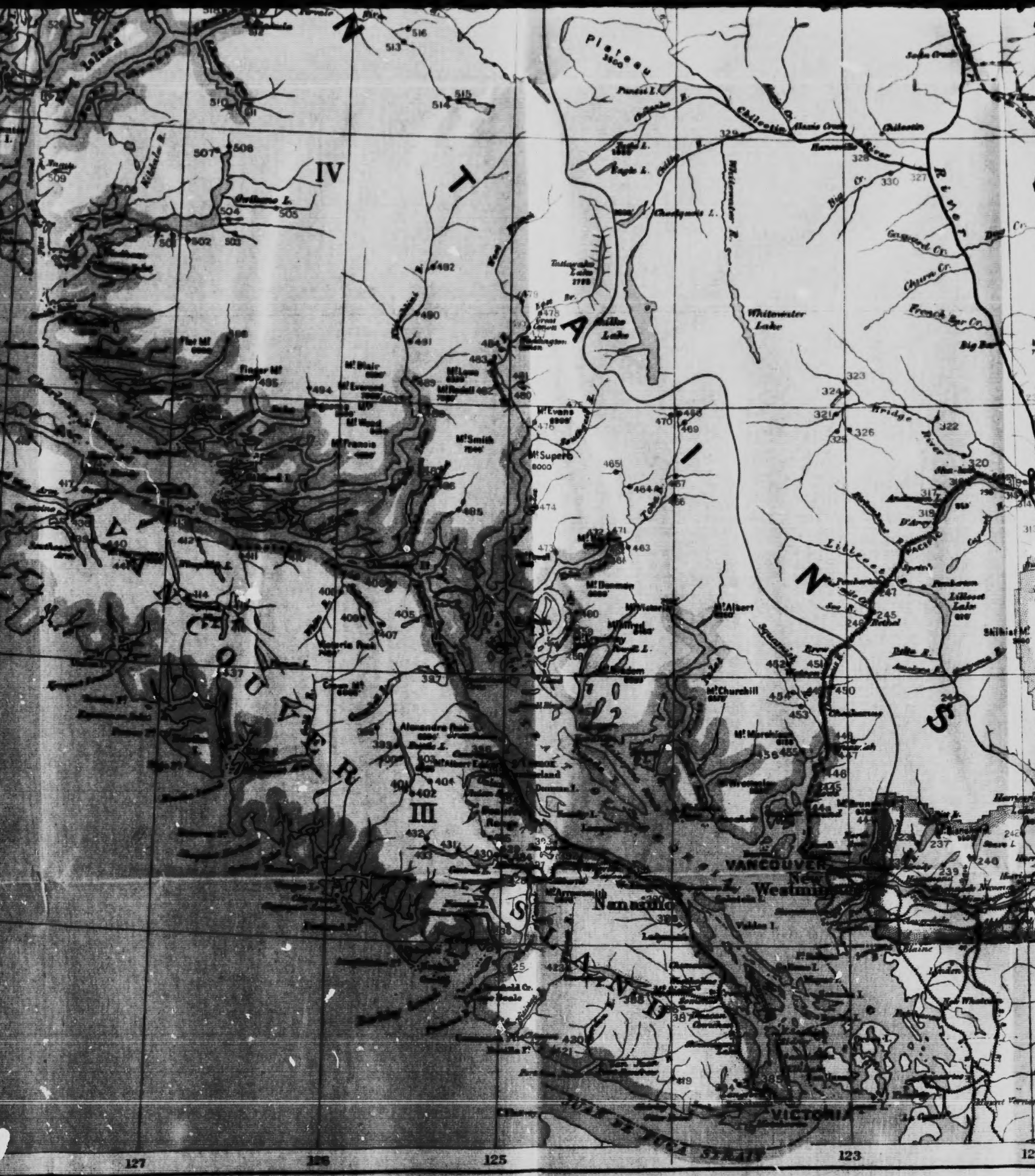
128



Plateau
Chilcotin
Chilcotin River
Whitewater Lake
Chezlyneeta L.
French Bar Cr.
Big Bar
Big Cr.
Gaspard Cr.
Churn Cr.
Bridge River
Lillooet Lake
Pemberton
D'Arcy
Mt Evans
Mt Superb 8000
Mt Smith
Mt Francis
Mt Churchill
Mt Albert
Alexandra Peak
Victoria Peak
IV
III
VANCOUVER
New Westminster
Nanaimo
VICTORIA
JUAN DE FUCA STRAIT
Blaine
127
126
125
123
122

VANCOUVER
VICTORIA
Kamloops
Ashcroft
Penticton
Kelowna
Lillooet Lake
Cairn Mt
Mt. Baker
Whitewater Lake
U N I T E D
STRAIT
123
122
121
120
119

Base map from enlargements of plates of Dominion Map of Canada, Department of Interior